# VALVES AND Electron Tubes

## TECHNICAL DATA

Mullard

£5—

# A CATALOGUE OF MULLARD RADIO RECEIVING VALVES AND SPECIAL ELECTRON TUBES




MULLARD OVERSEAS LTD.,
CENTURY HOUSE, SHAFTESBURY AVE., LONDON, ENGLAND.

MVE 3319

# INTRODUCTION

To millions of people throughout the world the Mullard name is associated with electronic products of the most advanced techniques and the highest quality. To those who have visited the Mullard organisation in this country, it means much more. For they have seen something of the company's extensive research facilities and great manufacturing resources.

The first few pages of this catalogue give some impression of these ramifications; we hope they will be read with interest.

For the rest, this is a catalogue of Mullard radio valves and electron tubes, and it contains descriptive details of every type in the current manufacturing programme. The most important of these to the designer of new equipment are indicated by HEAVY PRINT in the "Valve Data" section. These are the "Preferred Types" which embody the latest advances; which are in large scale production; and which will be available for maintenance for many years.

The remaining valves and tubes are, generally, normal maintenance types, the majority of which are in production or readily available from stock. A small number, however, are not being manufactured, but they have been included because they may still be available in the Trade. This means that inclusion in this catalogue of any particular type of valve or tube does not necessarily imply that it can be supplied.

It has, of course, only been possible to include abridged technical data but this should be adequate for normal requirements. Those who need more comprehensive information on the complete range of Mullard valves and tubes are invited to subscribe to the Technical Handbook Service, details of which will be found on page 66.

Advice on the use and applications of Mullard valves and electron tubes is freely available to designers and manufacturers of equipment, and to research workers. The world-wide network of Mullard distributors is constantly supplied with technical information from England, but where it is not possible for users to avail themselves of these services, they are invited to write direct to Head Office.

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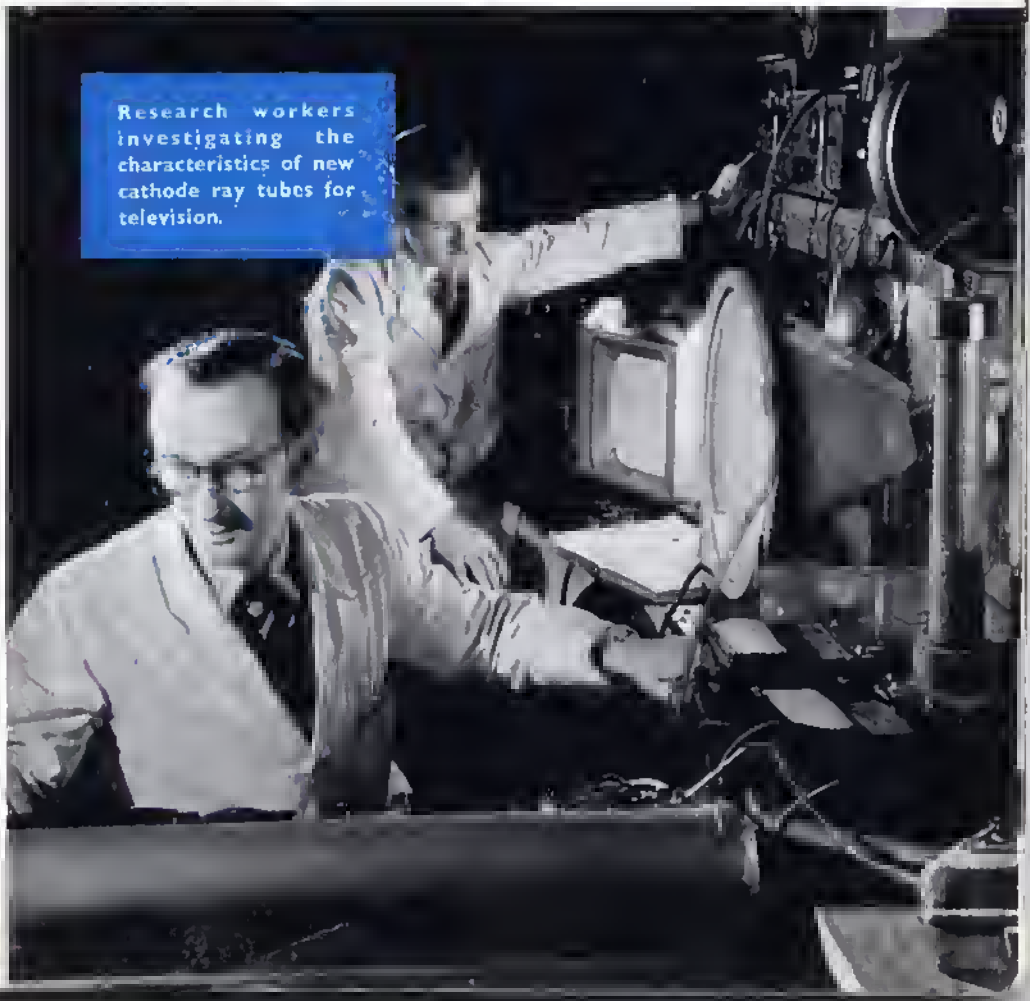
# THE MULLARD ORGANISATION

The Mullard production and research organisation is the largest of its kind in the British Commonwealth. Its products range from all types of valves and electron tubes for radio, television, industry, and research to a wide variety of magnetic materials and components. For certain specialised applications complete electronic equipments are also manufactured.

The quality of these products is carefully controlled at every stage of manufacture, and in many cases processing actually starts with the raw materials. By working to these critical standards the full benefits of Mullard research are realised in the finished products.

## ELECTRONICS RESEARCH

Mullard leadership in electronics is, indeed, largely due to the unceasing work of its team of research workers. Electronics research on the broadest lines is conducted in the Mullard Research Laboratory,



Research workers investigating the characteristics of new cathode ray tubes for television.

situated near Redhill, Surrey. Here physicists, chemists, metallurgists, mathematicians, engineers, and glass technologists collaborate in the design and development of new and special electron tubes, and new techniques and processes. Here, too, investigations are made of specific problems affecting the applications of electronics to other branches of research, and to the fields of industry, communications, and medicine.

Two other vitally important links in the Mullard research organisation are the Valve Measurement and Applications Laboratory and the Materials Research Laboratory, both at Mitcham, Surrey.

The Valve Measurement and Applications Laboratory collaborates with Development Departments, in the main production units, in the design of new and improved valves and cathode ray tubes. Data and circuitry resulting from this work are distributed by the Electronic Tube Department of Mullard Overseas Limited to electronic equipment designers throughout the world.

At the Materials Research Laboratory investigations are

Examining the atomic structure of a material by means of an X-ray diffraction apparatus.

Fine tungsten wire is used for the filaments of valves and electron tubes. The picture shows an early stage in wire drawing.

made into the physical and chemical properties of the great variety of materials used in the manufacture of electron tubes. This laboratory also provides a comprehensive service on materials to the Mullard factories in solving production problems and improving manufacturing processes.

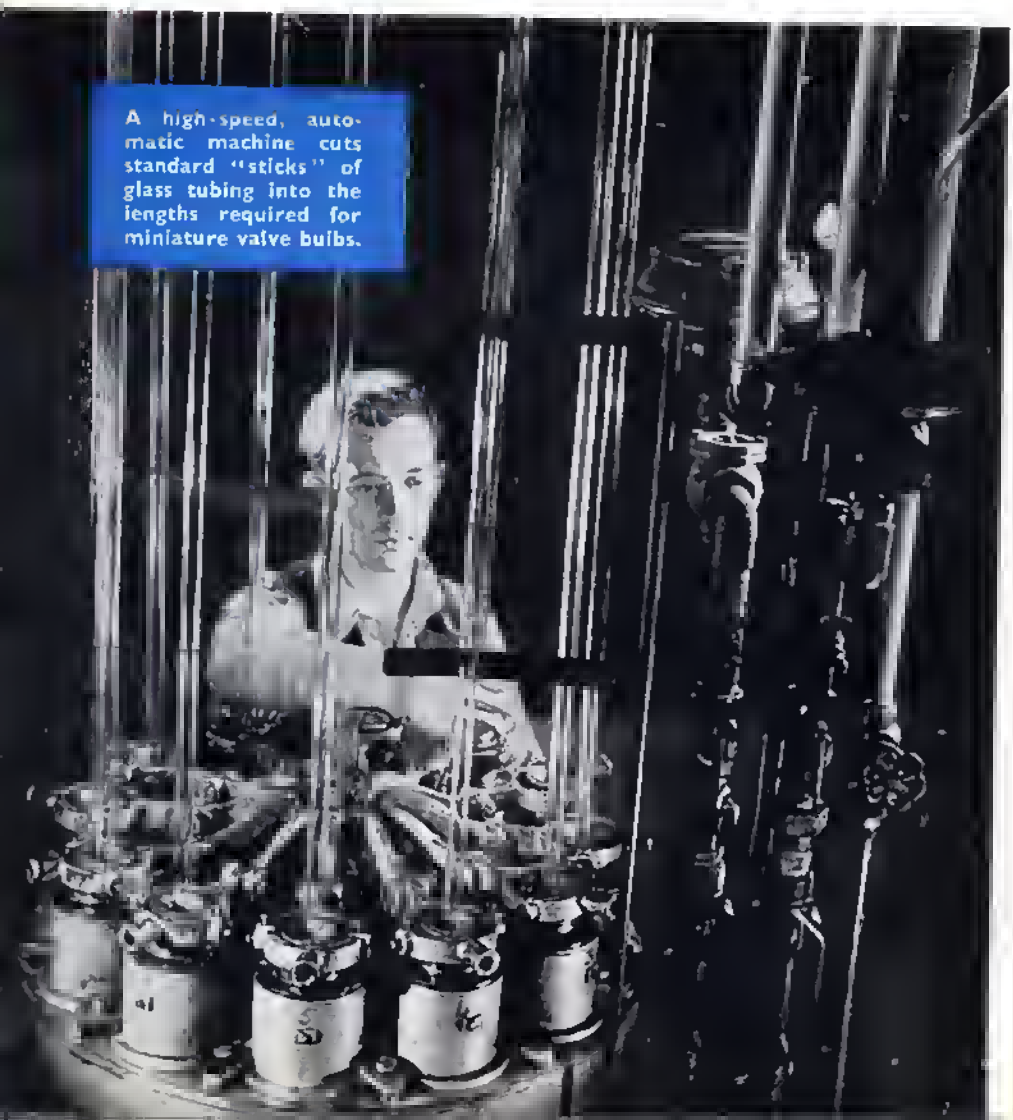
## WIRE AND GLASS MANUFACTURE

This emphasis on the quality of materials is vitally necessary in view of the high performance and reliability demanded of modern valves and electron tubes. To maintain the highest possible standard in the finished products it is essential to control the quality of raw materials at the earliest possible stage. The wire and glass used in Mullard valves and tubes, for example, are produced from the actual raw materials in the company's own factories at Blackburn. In this way it is not only possible to control quality throughout every stage of manufacture, but also to ensure continuity of supply.

On an average, more than five million yards of fine wire—tungsten for valve filaments, and molybdenum for grids, filament supports, and mandrils—are produced at the Blackburn plant each week. Some of this will be less than 8 microns (3/10,000th inch) diameter or 1/10th the thickness of an average human hair.

The manufacture of this wire is a fine example of the application of science to modern industry. Through a long and elaborate series of operations, a handful of powder is transformed into miles of wire, every inch of which conforms to the most exacting standards. To ensure that these high standards are maintained, the diamond dies, through which the finer wire is drawn, are also manufactured at Blackburn.

The manufacture of glass for electron tubes also involves a number of highly technical operations. In the Mullard glass plant, the raw materials —silica (sand), soda ash, potash and red lead—are converted into thousands



A high-speed, automatic machine cuts standard "sticks" of glass tubing into the lengths required for miniature valve bulbs.

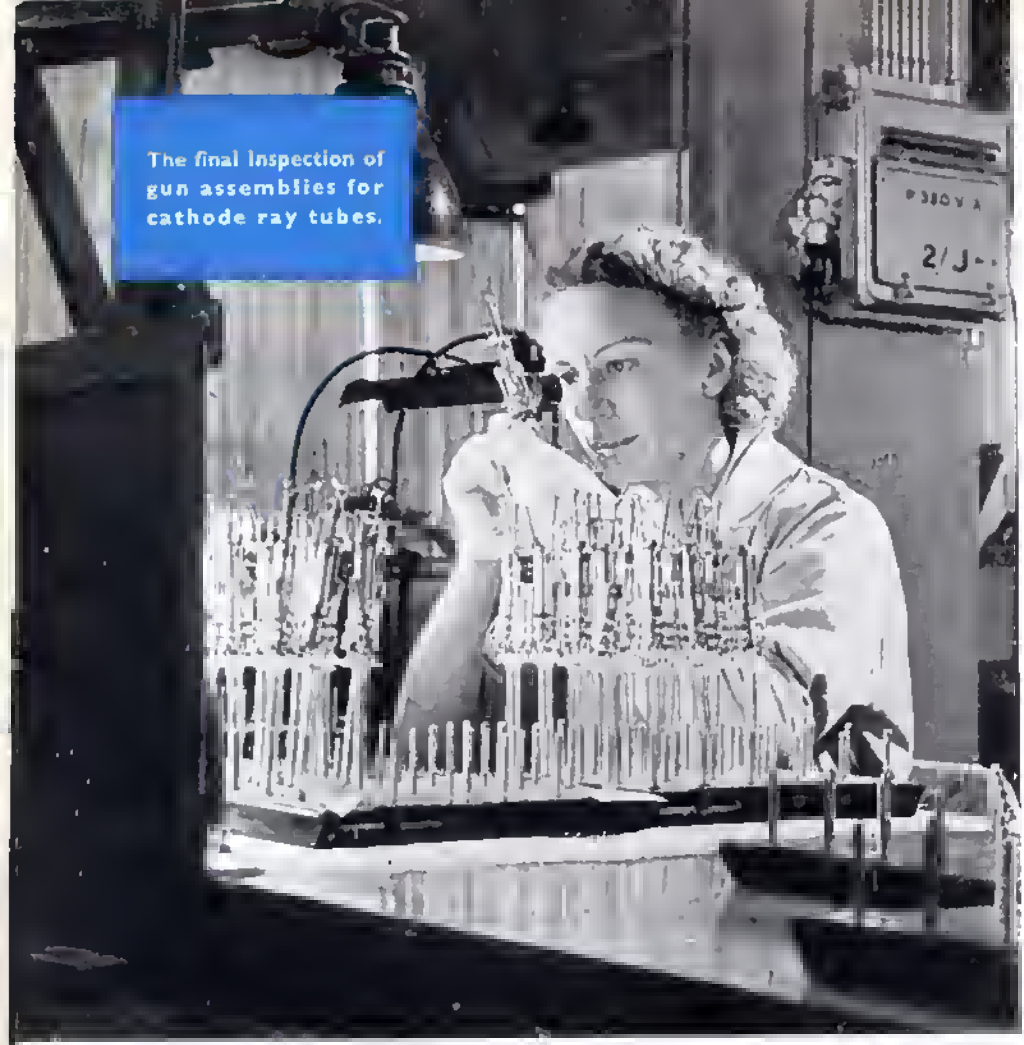
of feet of glass tubing having a wall thickness controlled to tolerances as close as 1/500th inch.

From these standard "sticks" of tubing the bulbs and bases for the latest all-glass valves are made, as well as parts for the older, pinch-type valves. The Blackburn glass factory produces millions of glass components every year for distribution to the various valve production units within the Mullard organisation. Some of the glass parts for cathode ray tubes are also made here, and glass bulbs for the tubes are assembled in large quantities.

## VALVE PRODUCTION

The strict control of quality, applied throughout the raw material stage, is continued in the manufacture of valve and cathode ray tube components—filaments, grids, anodes, mica discs, etc. With few exceptions,

Glass bulbs for miniature valves ready for transport to the assembly department.



The final inspection of gun assemblies for cathode ray tubes.

these parts are produced on intricate machines, designed and constructed in the company's own engineering department.

The highly skilled operations involved in assembling the components can only be carried out by hand. A high degree of mechanisation, however, is again employed in sealing the assemblies into their glass envelopes, and then exhausting these to a hard vacuum.

Careful inspections are made at every stage of manufacture and the finished products are subjected to rigorous production tests. Before the valves and cathode ray tubes are released for use, however, further intensive tests are carried out in specially-equipped technical departments.

The two main Mullard production units situated in Lancashire and Surrey, supported by five feeder factories, produce a major portion of the total output of valves and electron tubes made in the British Isles. Whilst radio valves and television picture tubes account for the greater part of the Mullard output, special tubes for industrial, medical, and research applications are also produced in vast quantities.

# ALPHABETICAL INDEX TO VALVE DATA

## ALPHABETICAL INDEX TO VALVE DATA

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# ALPHABETICAL INDEX TO VALVE DATA

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| **VOLTAGE AMPLIFYING PENTODES** | | | | |
| DF66 | 0·625 | 0·015 | Hearing-aid pentode. | 28 |
| DF91 | 1·4 | 0·05 | Variable-mu R.F. pentode. | 28 |
| DF92 | 1·4 | 0·05 | Short grid base R.F. pentode. | 28 |
| EF37A | 6·3 | 0·2 | Low microphony, low hum A.F. pentode. | 29 |
| EF40 | 6·3 | 0·2 | Low noise A.F. pentode. | 29 |
| EF41 | 6·3 | 0·2 | Variable-mu R.F. pentode. | 29 |
| EF80 | 6·3 | 0·3 | High slope R.F. pentode. | 29 |
| EF95 | 6·3 | 0·175 | High slope R.F. pentode. | 29 |
| UF41 | 12·6 | 0·1 | Variable-mu R.F. pentode. | 30 |
| **VOLTAGE AMPLIFYING PENTODES WITH DIODES** | | | | |
| DAF91 | 1·4 | 0·05 | Short grid base A.F. pentode with single diode. | 31 |
| EBF80 | 6·3 | 0·3 | Variable-mu R.F. pentode with double diode. | 31 |
| UBF80 | 17 | 0·1 | Variable-mu R.F. pentode with double diode. | 31 |
| **FREQUENCY CHANGERS** | | | | |
| DK92 | 1·4 | 0·05 | Heptode. | 32 |
| ECH42 | 6·3 | 0·23 | Triode hexode. | 32 |
| UCH42 | 14 | 0·1 | Triode hexode. | 33 |
| **SINGLE AND DOUBLE DIODES** | | | | |
| DA90 | 1·4 | 0·15 | Indirectly heated single diode. | 33 |
| EB91 | 6·3 | 0·3 | Double diode with separate cathodes. | 34 |
| **TRIODES AND DOUBLE TRIODES** | | | | |
| DCC90 | 1·4 / 2·8 | 0·22 / 0·11 | R.F. double triode, suitable for portable transmitters. | 34 |
| ECC33 | 6·3 | 0·4 | A.F. double triode with separate cathodes. | 34 |
| ECC35 | 6·3 | 0·4 | A.F. double triode with separate cathodes. | 35 |
| ECC40 | 6·3 | 0·6 | A.F. double triode with separate cathodes. | 35 |
| ECC81 | 6·3 / 12·6 | 0·3 / 0·15 | R.F. double triode with separate cathodes. | 35 |
| ECC91 | 6·3 | 0·45 | R.F. double triode with common cathode. | 35 |
| ECL80 | 6·3 | 0·3 | Triode combined with output pentode. | 35 |
| **TRIODES WITH DIODES** | | | | |
| EBC41 | 6·3 | 0·23 | Double diode triode. | 36 |
| UBC41 | 14 | 0·1 | Double diode triode. | 36 |

## VALVE APPLICATION INDEX OF PREFERRED TYPES

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| **OUTPUT PENTODES** | | | | |
| DL66 | 1·25 | 0·015 | Hearing-aid output pentode. | 37 |
| DL68 | 1·25 | 0·025 | Hearing-aid output pentode. | 37 |
| DL92 | 1·4 / 2·8 | 0·1 / 0·05 | A.F. output pentode. | 37 |
| DL93 | 1·4 / 2·8 | 0·2 / 0·1 | R.F. or A.F. output pentode. | 37 |
| DL94 | 1·4 / 2·8 | 0·1 / 0·05 | A.F. output pentode. | 37 |
| ECL80 | 6·3 | 0·3 | Output pentode (pa max.=3·5 W) combined with triode | 37 |
| EL37 | 6·3 | 1·4 | Output pentode (pa max.=25 W). | 38 |
| EL38 | 6·3 | 1·4 | Line time base output pentode. | 38 |
| EL41 | 6·3 | 0·7 | Output pentode (pa max.=9 W) | 38 |
| EL42 | 6·3 | 0·2 | Output pentode (pa max.=6 W). | 38 |
| EL81 | 6·3 | 1·05 | Series stabiliser and line time base output pentode. | 38 |
| PL81 | 21·5 | 0·3 | Line time base output pentode. | 39 |
| PL82 | 16·5 | 0·3 | Output pentode (pa max.=9 W). | 39 |
| PL83 | 15 | 0·3 | Video output pentode. | 39 |
| UL41 | 45 | 0·1 | Output pentode (pa max.=9 W). | 39 |
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| EM34 | 6·3 | 0·2 | Dual sensitivity tuning indicator. | 41 |
| **RECTIFIERS** | | | | |
| EY51 | 6·3 | 0·09 | High voltage rectifier for E.H.T. supplies. | 42 |
| EZ40 | 6·3 | 0·6 | Indirectly heated full-wave rectifier. | 42 |
| EZ41 | 6·3 | 0·4 | Indirectly heated full-wave rectifier. | 42 |
| GZ32 | 5·0 | 2·3 | Indirectly heated full-wave rectifier. | 42 |
| PY80 | 19 | 0·3 | Booster diode. | 42 |
| PY81 | 17 | 0·3 | Booster diode. | 42 |
| PY82 | 19 | 0·3 | Indirectly heated half-wave rectifier. | 43 |
| UY41 | 31 | 0·1 | Indirectly heated half-wave rectifier. | 43 |
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| MT57 | 5·0 | 4·5 | Mercury-vapour triode. | 46 |
| MT105 | 5·0 | 10 | Mercury-vapour tetrode. | 46 |
| MT5544 | 2·5 | 12 | Inert-gas-filled triode. | 46 |
| MT5545 | 2·5 | 21 | Inert-gas-filled triode. | 46 |
| 2D21 | 6·3 | 0·6 | Inert-gas-filled tetrode. | 46 |
| 1267 | Cold cathode | | Inert-gas-filled triode. | 46 |

## VALVE APPLICATION INDEX OF PREFERRED TYPES

## VALVE APPLICATION INDEX OF PREFERRED TYPES

# REFERENCES

**a** Anode. C.R.T. anodes marked a1, a2, etc., a1 being nearest the cathode.
**g** Grid. Grids marked g1, g2, etc., g1 being nearest the cathode.
**k** Cathode.
**f** Filament.
**h** Heater.
**s** Internal shield.
**M** External metallising.
**T** Trigger electrode (Flash-tubes).
**IC** Internal connection; not to be used for external connections.

**Va** Anode voltage.
**Vg2** Screen grid voltage.
**Vg1** Control grid voltage.
} *Not applicable to frequency changers with additional oscillator electrodes.*

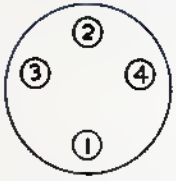
**Vf** Filament voltage.
**Vh** Heater voltage.
**va(pk)** Peak anode voltage.
**P.I.V.** Peak inverse voltage.
**Ia** Anode current.
**Ig2** Screen grid current.
**If** Filament current.
**Ih** Heater current.
**It** Target current.
**Iout** Output current.
**ia(pk)** Peak anode current.
**Pout** Output power.
**pa** Anode dissipation.
**Ra** External anode load.
**Rk** Cathode bias resistor.
**ra** Internal anode impedance.
**$\mu$** Amplification factor.
**gm** Mutual conductance.
**gc** Conversion conductance.
**S** Sensitivity (cathode ray tubes).

## BASE REFERENCES

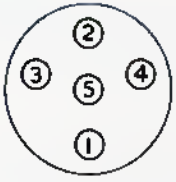
**A** British 4-pin.
**K** International octal.
**M** British 7-pin.
**MO** Mazda octal.
**O** British 5-pin.
**P** Side contact (8-contact).
**UX** American base.
**V** Side contact (5-contact).
**Y** European 8-pin.
**B2A** 2 wire-in leads.
**B3A** American Pee-wee 3-pin.
**B3G** 3-pin all-glass.
**B4D** Super Jumbo 4-pin.
**B5A** Flat subminiature.
**B7G** 7-pin miniature.
**B8A** 8-pin miniature.
**B8D** 10 mm. round subminiature.
**B8G** Loctal.
**B9A** 9-pin miniature (noval).
**B9G** 9-pin all-glass.
**B12A** Duodecal.
**B14A** Diheptal.

# VALVE BASE DIAGRAMS

viewed from free end of pins

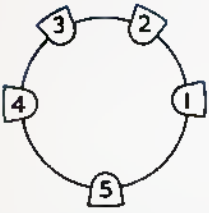


British 4-pin (A Base)



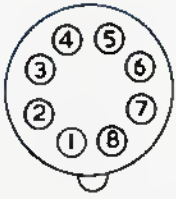
British 5-pin (O Base)

British 7-pin (M Base)



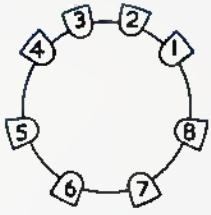
Side Contact (V Base)

Noval (B9A)



8-pin Miniature (B8A)

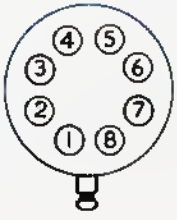
Duodecal (B12A)



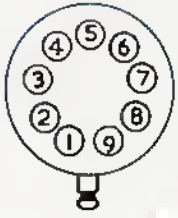
Side Contact (P Base)

Octal (K Base)

7-pin Miniature (B7G)

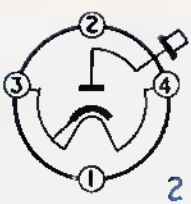


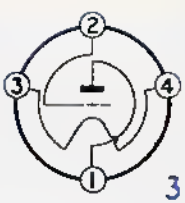
Loctal (B8G)

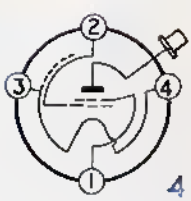


9-pin All glass (B9G)

# VALVE BASE DIAGRAMS

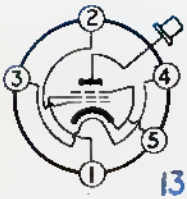









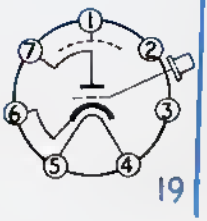


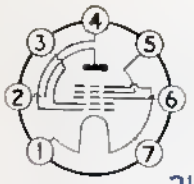









# VALVE BASE DIAGRAMS



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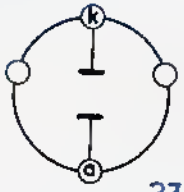

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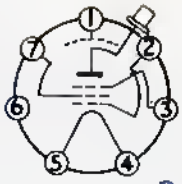

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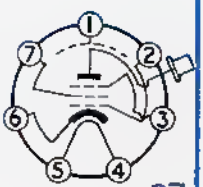

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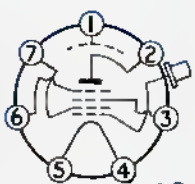

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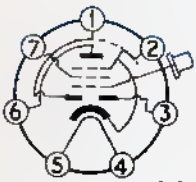

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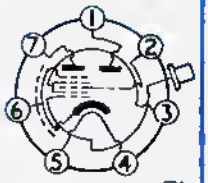

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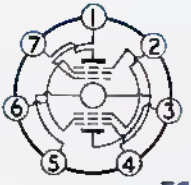

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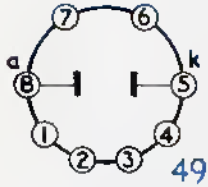

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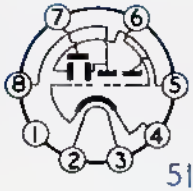

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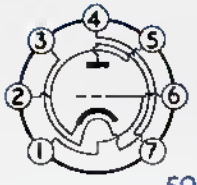

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# VALVE BASE DIAGRAMS

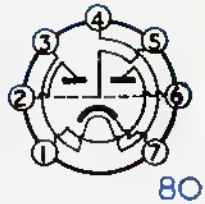






















# VALVE BASE DIAGRAMS



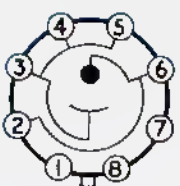






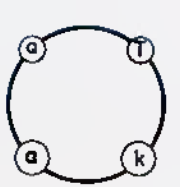


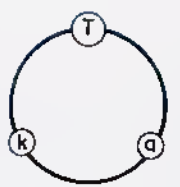


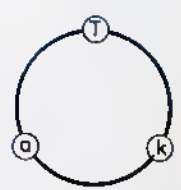









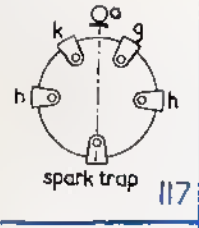







# VALVE BASE DIAGRAMS



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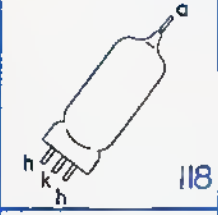

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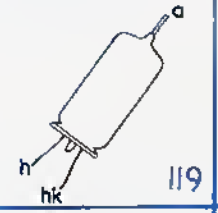

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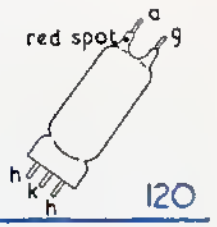

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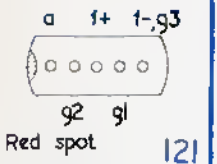

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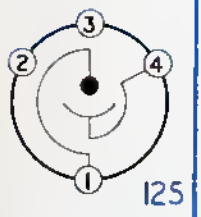

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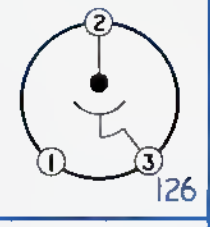

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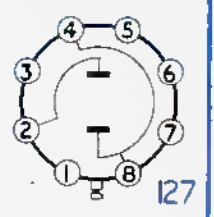

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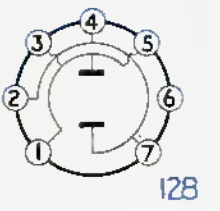

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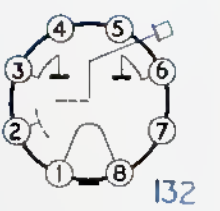

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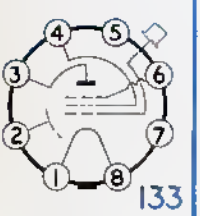

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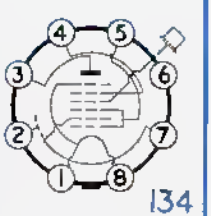

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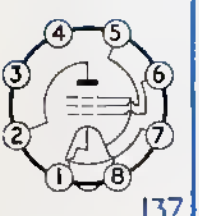

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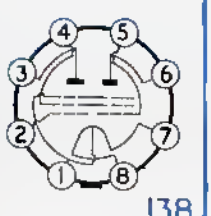

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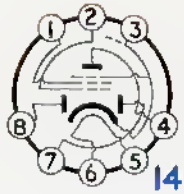
# VALVE BASE DIAGRAMS













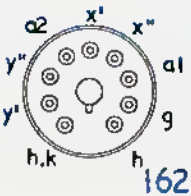


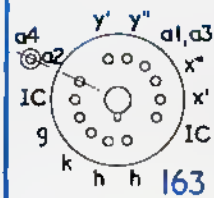




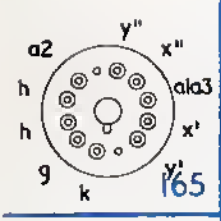





# VALVE BASE DIAGRAMS



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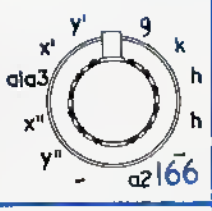

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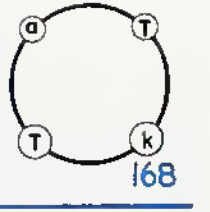

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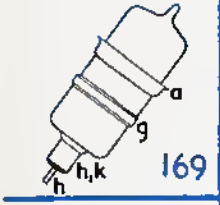

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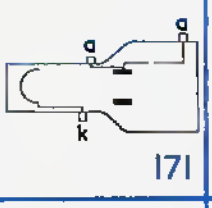

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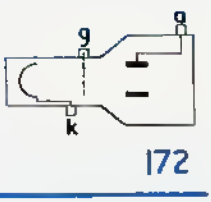

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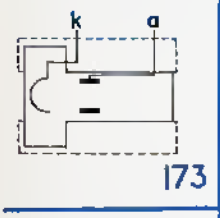

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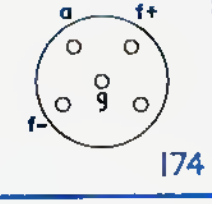

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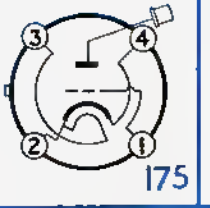

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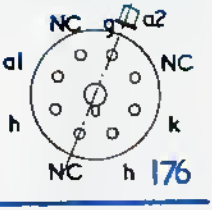

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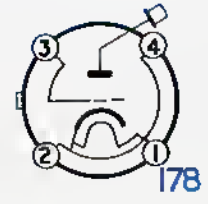

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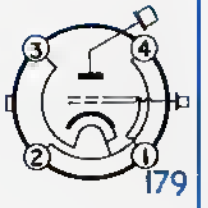

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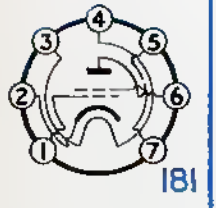

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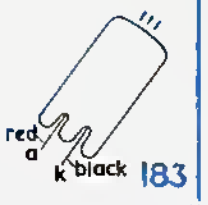

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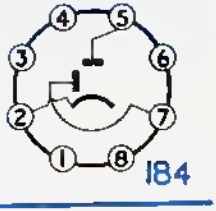

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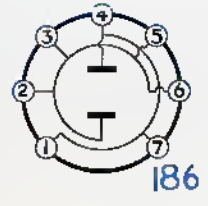

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These diagrams are referred to in the Alphabetical Index and the Base column of the Valve Data section.

# VALVE DATA

## VOLTAGE AMPLIFYING PENTODES

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va (V) | Vg2 (V) | −Vg1 (V) | Ia (mA) | Ig2 (mA) | gm (mA/V) | ra (MΩ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AF3 | Variable-mu R.F. Pentode | P. (47) | 4·0 | 0·65 | 250 | 100 | 3·0 | 8·0 | 2·6 | 1·8 | 1·2 |
| AF7 | Short Grid Base R.F. Pentode | P. (47) | 4·0 | 0·65 | 250 | 100 | 2·0 | 3·0 | 1·1 | 2·1 | 2·0 |
| DF21 | Short Grid Base R.F. or A.F. Pentode | Octal (133) | 1·4 | 0·025 | 90 | 90 | 0 | 1·2 | 0·25 | 0·7 | 2·0 |
| DF22 | Variable-mu R.F. Pentode | Octal (133) | 1·4 | 0·05 | 90 | 90 | 1·5 | 1·4 | 0·3 | 1·1 | 1·5 |
| DF33 | Variable-mu R.F. Pentode | Octal (67) | 1·4 | 0·05 | 90 | 90 | 0 | 1·2 | 0·3 | 0·75 | 1·5 |
| **DF66** | **Hearing-aid Pentode** | **B5A (121)** | **0·625** | **0·015** | **22·5** | **22·5** | **1·05** | **0·05** | **0·015** | **0·1** | **2·0** |
| DF70 | Hearing-aid Pentode | 88D (16) | 0·625 | 0·025 | 30 | 30 | 0 | 0·375 | 0·125 | 0·22 | 0·5 |
| **DF91** | **Variable-mu R.F. Pentode** | **B7G (38)** | **1·4** | **0·05** | **90** | **67·5** | **0** | **3·5** | **1·4** | **0·9** | **0·5** |
| **DF92** | **Short Grid Base R.F. Pentode** | **B7G (38)** | **1·4** | **0·05** | **90** | **67·5** | **17** | **—** | **—** | **0·009** | **—** |
| | | | | | | | **0** | **3·7** | **1·4** | **1·0** | **0·5** |
| ECF1 | Variable-mu R.F. Pentode combined with Triode (for Triode data see p. 35) | P. (143) | 6·3 | 0·2 | 250 | 100 | 2·0 | 5·0 | 2·0 | 2·0 | 1·6 |
| EF9 | Variable-mu R.F. Pentode | P. (47) | 6·3 | 0·2 | 250 | Rg2= 90 KΩ | 2·5 | 6·0 | 1·7 | 2·2 | 1·25 |
| EF11 | Variable-mu R.F. Pentode | Y. (146) | 6·3 | 0·2 | 250 | Rg2= 75 KΩ | 2·0 | 6·0 | 2·0 | 2·2 | 2·0 |
| EF12 | Short Grid Base R.F. Pentode | Y. (146) | 6·3 | 0·2 | 250 | 100 | 2·0 | 3·0 | 1·0 | 2·1 | 2·0 |
| EF22 | Variable-mu R.F. Pentode | 88G (86) | 6·3 | 0·2 | 250 | Rg2= 90 KΩ | 2·5 | 6·0 | 1·7 | 2·2 | 1·2 |

## VOLTAGE AMPLIFYING PENTODES – *continued*

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va (V) | Vg2 (V) | −Vg1 (V) | Ia (mA) | Ig2 (mA) | gm (mA/V) | ra (MΩ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EF36 | Short Grid Base R.F. or A.F. Pentode .. .. | Octal (72) | 6·3 | 0·2 | 250 | 100 | 2·0 | 3·0 | 0·8 | 1·8 | 2·5 |
| EF37 | Low Microphony A.F. Pentode .. .. .. | Octal (72) | 6·3 | 0·2 | 250 | 100 | 2·0 | 3·0 | 0·8 | 1·8 | 2·5 |
| **EF37A** | **Low Microphony, Low Hum A.F. Pentode** | **Octal (72)** | **6·3** | **0·2** | **250** | **100** | **2·0** | **3·0** | **0·8** | **1·8** | **2·5** |
| EF39 | Variable-mu R.F. Pentode .. .. .. .. | Octal (72) | 6·3 | 0·2 | 250 | Rg2= 90 KΩ | 2·5<br>39 | 6·0<br>— | 1·7<br>— | 2·2<br>0·022 | 1·25<br>>10 |
| **EF40** | **Low Noise A.F. Pentode .. .. ..** | **BBA (9B)** | **6·3** | **0·2** | **250** | **140** | **2·0** | **3·0** | **0·55** | **1·85** | **2·5** |
| **EF41** | **Variable-mu R.F. Pentode .. .. ..** | **BBA (96)** | **6·3** | **0·2** | **250** | **Rg2= 90 KΩ** | **2·5<br>39** | **6·0<br>—** | **1·7<br>—** | **2·2<br>0·022** | **1·0<br>>10** |
| EF42 | High Slope R.F. Pentode .. .. .. .. | BBA (95) | 6·3 | 0·33 | 250 | 250 | 2·0 | 10 | 2·3 | 9·5 | 0·44 |
| EF50 | High Slope R.F. Pentode .. .. .. .. | B9G (90) | 6·3 | 0·3 | 250 | 250 | 2·0 | 10 | 3·0 | 6·5 | 1·0 |
| EF54 | High Slope R.F. Pentode .. .. .. .. | B9G (91) | 6·3 | 0·3 | 250 | 250 | 1·7 | 10 | 1·45 | 7·7 | 0·5 |
| EF55 | High Slope R.F. Pentode for use in Video Amplifiers .. .. .. .. .. | B9G (90) | 6·3 | 1·0 | 250 | 250 | 4·5 | 40 | 5·5 | 12 | 0·055 |
| **EF80** | **High Slope R.F. Pentode .. .. ..** | **B9A (104)** | **6·3** | **0·3** | **170** | **170** | **2·0** | **10** | **2·5** | **7·4** | **0·4** |
| EF91 | High Slope R.F. Pentode .. .. .. .. | B7G (74) | 6·3 | 0·3 | 250 | 250 | 2·0 | 10 | 2·5 | 7·6 | 1·0 |
| EF92 | Variable-mu R.F. Pentode .. .. .. .. | B7G (74) | 6·3 | 0·2 | 250 | 200 | 2·5 | 8·0 | 2·1 | 2·5 | 0·5 |
| **EF95** | **High Slope R.F. Pentode .. .. ..** | **B7G (147)** | **6·3** | **0·175** | **180** | **120** | **2·0** | **7·7** | **2·4** | **5·1** | **0·69** |
| KF3 | Variable-mu R.F. Pentode .. .. .. .. | P. (154) | 2·0 | 0·045 | 135 | 135 | 0·5 | 2·0 | 0·6 | 0·65 | 1·3 |
| KF35 | Variable-mu R.F. Pentode .. .. .. .. | Octal (6B) | 2·0 | 0·05 | 120 | 60 | 1·5 | 1·45 | 0·5 | 1·0 | — |
| PM12M | Variable-mu R.F. Tetrode .. .. .. .. | British 4-pin (4) | 2·0 | 0·18 | 150 | 90 | 0 | 2·5 | 0·5 | 1·4 | — |
| SP2 | Short Grid Base R.F. Pentode .. .. .. | British 7-pin (24) | 2·0 | 0·18 | 135 | 135 | 0 | 3·0 | 1·0 | 1·8 | 0·7 |

## VOLTAGE AMPLIFYING PENTODES—*continued*

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va (V) | Vg2 (V) | −Vg1 (V) | Ia (mA) | Ig2 (mA) | gm (mA/V) | ra (MΩ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SP4 | Short Grid Base R.F. Pentode .. .. .. | British 5- or 7-pin (13 or 27) | 4·0 | 1·0 | 200 | 100 | 2·0 | 3·0 | 1·1 | 2·3 | 2·2 |
| SP4B | Sharp Cut-off R.F. Pentode .. .. .. | British 7-pin (26) | 4·0 | 0·65 | 250 | 250 | 2·4 | 4·0 | 1·5 | 3·4 | 2·0 |
| SP13 | Sharp Cut-off R.F. Pentode .. .. .. | P. (47) | 13 | 0·2 | 200 | 100 | 2·0 | 3·3 | 1·2 | 2·2 | 1·3 |
| SP13C | Sharp Cut-off R.F. Pentode .. .. .. | British 7-pin (26) | 13 | 0·2 | 200 | 200 | 2·2 | 2·5 | 0·9 | 2·8 | 2·5 |
| UF9 | Variable-mu R.F. Pentode .. .. .. .. | Octal (158) | 12·6 | 0·1 | 200 | Rg2= 60 KΩ | 2·5 | 6·0 | 1·7 | 2·2 | 1·2 |
| UF11 | Variable-mu R.F. Pentode .. .. .. .. | Y. (146) | 15 | 0·1 | 200 | Rg2= 70 KΩ | 2·0 | 6·0 | 1·7 | 2·2 | 1·5 |
| UF21 | Variable-mu R.F. Pentode .. .. .. .. | 88G (86) | 12·6 | 0·1 | 200 | Rg2= 60 KΩ | 2·5 | 6·0 | 1·7 | 2·2 | 1·0 |
| **UF41** | **Variable-mu R.F. Pentode .. .. ..** | **B8A (96)** | **12·6** | **0·1** | **170** | **Rg2= 39 KΩ** | **2·5** / **28** | **6·0** / **—** | **1·75** / **—** | **2·2** / **0·022** | **1·0** / **>10** |
| UF42 | High Slope R.F. Pentode .. .. .. .. | B8A (95) | 21 | 0·1 | 170 | 170 | 2·0 | 10 | 2·8 | 8·5 | 0·2 |
| VP2 | Variable-mu R.F. Pentode .. .. .. .. | British 7-pin (24) | 2·0 | 0·18 | 135 | 135 | 0 | 3·0 | 1·25 | 1·5 | 0·4 |
| VP2B | Variable-mu R.F. Hexode .. .. .. .. | British 7-pin (28) | 2·0 | 0·135 | 135 | 60* | 1·5 | 2·0 | 0·95 | 1·4 | 1·3 |
| VP4 | Variable-mu R.F. Pentode .. .. .. .. | British 5- or 7-pin (13 or 27) | 4·0 | 1·0 | 200 | 100 | 2·0 | 4·5 | 1·9 | 2·3 | 1·0 |
| VP4A | Variable-mu R.F. Pentode .. .. .. .. | British 5- or 7-pin (13 or 27) | 4·0 | 1·2 | 200 | 100 | 2·0 | 4·25 | 1·8 | 2·5 | 1·4 |
| VP4B | Variable-mu R.F. Pentode .. .. .. .. | British 7-pin (26) | 4·0 | 0·65 | 250 | 250 | 3·0 | 11·5 | 4·25 | 2·0 | — |
| VP13A | Variable-mu R.F. Pentode .. .. .. .. | P. (47) | 13 | 0·2 | 200 | 100 | 2·0 | 4·0 | 1·4 | 2·2 | — |
| VP13C | Variable-mu R.F. Pentode .. .. .. .. | British 7-pin (26) | 13 | 0·2 | 200 | 200 | 2·0 | 9·0 | 3·6 | 2·2 | — |

* Vg3 = Vg2, Vg4 = 0

## VOLTAGE AMPLIFYING PENTODES WITH DIODE(S)

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va (V) | Vg2 (V) | −Vg1 (V) | Ia (mA) | Ig2 (mA) | gm (mA/V) | ra (MΩ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **OAF91** | **Short Grid Base A.F. Pentode with Single Diode** | **B7G (40)** | **1·4** | **0·05** | **90** | **90** | **0** | **2·7** | **0·5** | **0·72** | **0·5** |
| EAF42 | Variable-mu R.F. Pentode with Single Diode | B8A (93) | 6·3 | 0·2 | 250 | Rg2= 110 KΩ | 2·0<br>43 | 5·0<br>— | 1·5<br>— | 2·0<br>0·02 | 1·4<br>— |
| E8F2 | Variable-mu R.F. Pentode with Double Diode | P. (140) | 6·3 | 0·2 | 250 | Rg2= 95 KΩ | 2·0 | 5·0 | 1·6 | 1·8 | 1·3 |
| EBF11 | Variable-mu R.F. Pentode with Double Diode | Y. (141) | 6·3 | 0·2 | 250 | Rg2= 85 KΩ | 2·0 | 5·0 | 1·8 | 1·8 | 2·0 |
| E8F32 | Variable-mu R.F. Pentode with Double Diode | Octal (75) | 6·3 | 0·2 | 250 | Rg2= 95 KΩ | 2·0 | 5·0 | 1·6 | 1·8 | 1·3 |
| **EBF80** | **Variable-mu R.F. Pentode with Double Diode** | **B9A (103)** | **6·3** | **0·3** | **250** | **Rg2= 95 KΩ** | **2·0<br>41·5** | **5·0<br>—** | **1·75<br>—** | **2·2<br>0·022** | **1·5<br>>10** |
| UAF42 | Variable-mu R.F. Pentode with Single Diode | 88A (93) | 12·6 | 0·1 | 170 | Rg2= 56 KΩ | 2·0<br>28 | 5·0<br>— | 1·5<br>— | 2·0<br>0·02 | 0·9<br>>10 |
| U8F11 | Variable-mu R.F. Pentode with Double Diode | Y. (141) | 20 | 0·1 | 200 | Rg2= 70 KΩ | 2·0 | 5·0 | 1·7 | 1·8 | 1·5 |
| **UBF80** | **Variable-mu R.F. Pentode with Double Diode** | **B9A (103)** | **17** | **0·1** | **170** | **Rg2= 47 KΩ** | **2·0<br>26·5** | **5·0<br>—** | **1·75<br>—** | **2·2<br>0·022** | **0·9<br>>10** |

## FREQUENCY CHANGERS

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va (V) | Vg2+4 (V) | −Vg1 (V) | Ia (mA) | Ig2+4 (mA) | gc (mA/V) | ra (KΩ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AK2 | Octode | P. (33) | 4·0 | 0·65 | 250 | 70 (Vg3+5) | 1·5 (Vg4) | 1·6 | 3·8 (Ig3+5) | 0·6 | 1,600 |
| CCH35 | Triode Hexode | Octal (82) | 7·0 | 0·2 | ●200<br>△100 | 100<br>— | 2·0<br>0 | 3·0<br>10 | 3·0<br>— | 0·65<br>— | 900<br>8·6 |
| DK21 | Octode | Octal (134) | 1·4 | 0·05 | 120 | Rg5= 120 KΩ | 0 (Vg4) | 1·5 | 0·25 (Ig5) | 0·5 | 500 |
| DK32 | Heptode | Octal (77) | 1·4 | 0·05 | 90 | 45 (Vg3+5) | 0 (Vg4) | 0·6 | 0·7 (Ig3+5) | 0·25 | 600 |

● Mixer Section. △ Triode Section.

## FREQUENCY CHANGERS—*continued*

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va (V) | Vg2+4 (V) | −Vg1 (V) | Ia (mA) | Ig2+4 (mA) | gc (mA/V) | ra (KΩ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DK40 | Octode | B8A (135) | 1·4 | 0·05 | 135 | Rg5= 270 KΩ | 0 (Vg4) | 1·0 | 0·25 (Ig5) | 0·425 | 1,000 |
| DK91 | Heptode | B7G (41) | 1·4 | 0·05 | 90 | 67·5 | 0 (Vg3) | 1·6 | 3·2 | 0·3 | 600 |
| **DK92** | **Heptode** | **B7G (21)** | **1·4** | **0·05** | **90** | **60 (Vg4)** | **0 (Vg3)** | **0·7** | **0·15 (Ig4)** | **0·325** | **650** |
| ECH3 | Triode Hexode | P. (52) | 6·3 | 0·2 | ● 250<br>△ 100 | 100<br>— | 2·0<br>0 | 3·0<br>10 | 3·0<br>— | 0·65<br>— | 1,300<br>8·6 |
| ECH11 | Triode Hexode | Y. (144) | 6·3 | 0·2 | ● 250<br>△ 150 | 100<br>— | 2·0<br>0 | 2·3<br>15·5 | 3·0<br>— | 0·65<br>— | 1,200<br>6·0 |
| ECH21 | Triode Heptode | B8G (88) | 6·3 | 0·33 | ● 250<br>△ 100 | 100<br>— | 2·0<br>0 | 3·0<br>12 | 6·2<br>— | 0·75<br>— | 1·4<br>6·5 |
| ECH33 | Triode Hexode | Octal (82) | 6·3 | 0·2 | ● 250<br>△ 100 | 100<br>— | 2·0<br>0 | 3·0<br>10 | 3·0<br>— | 0·65<br>— | 1,300<br>8·6 |
| ECH35 | Triode Hexode | Octal (82) | 6·3 | 0·3 | ● 250<br>△ 100 | 100<br>— | 2·0<br>0 | 3·0<br>10 | 3·0<br>— | 0·65<br>— | 1,300<br>8·6 |
| **ECH42** | **Triode Hexode** | **B8A (94)** | **6·3** | **0·23** | ● **250**<br>△ **100** | **85**<br>— | **2·0**<br>**0** | **3·0**<br>**10** | **3·0**<br>— | **0·75**<br>— | **1,000**<br>**8·0** |
| EK2 | Octode | P. (33) | 6·3 | 0·2 | 250 | 50 (Vg3+5) | 2 (Vg4) | 1·0 | 0·8 (Ig3+5) | 0·55 | 2,000 |
| EK32 | Octode | Octal (81) | 6·3 | 0·2 | 250 | 50 (Vg3+5) | 2 (Vg4) | 1·0 | 0·8 (Ig3+5) | 0·55 | 2,000 |
| FC2A | Octode | British 7-pin (32) | 2·0 | 0·13 | 135 | 45 (Vg3+5) | 0·5 (Vg4) | 0·7 | 0·7 (Ig3+5) | 0·27 | 2,500 |
| FC4 | Octode | British 7-pin (34) | 4·0 | 0·65 | 250 | 70 (Vg3+5) | 1·5 (Vg4) | 1·6 | 3·8 (Ig3+5) | 0·6 | — |
| FC13 | Octode | P. (33) | 13 | 0·2 | 200 | 70 (Vg3+5) | 1·5 (Vg4) | 1·6 | 3·8 (Ig3+5) | 0·6 | — |
| FC13C | Octode | British 7-pin (34) | 13 | 0·2 | 200 | 70 (Vg3+5) | 1·5 (Vg4) | 1·6 | 3·8 (Ig3+5) | 0·6 | — |
| KCF30 | Triode Pentode | Octal (170) | 2·0 | 0·2 | ● 120<br>△ 100 | 60 (Vg2)<br>— | 1·5<br>0 | 0·53<br>5·5 | 1·0 (Ig2)<br>— | 0·26<br>— | —<br>10·5 |

● Mixer Section. △ Triode Section.

## FREQUENCY CHANGERS—*continued*

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va (V) | Vg2+4 (V) | −Vg1 (V) | Ia (mA) | Ig2+4 (mA) | gc (mA/V) | ra (KΩ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| KK2 | Octode | P. (155) | 2·0 | 0·13 | 135 | 45 (Vg3+5) | 0·5 (Vg4) | 0·7 | 0·7 (Ig3+5) | 0·27 | 2,500 |
| KK32 | Octode | Octal (79) | 2·0 | 0·13 | 135 | 45 (Vg3+5) | 0·5 (Vg4) | 0·7 | 0·7 (Ig3+5) | 0·27 | — |
| TH4B | Triode Heptode | British 7-pin (31) | 4·0 | 1·45 | ● 250<br>△ 100 | 100<br>— | 2·5<br>0 | 3·25<br>9·5 | 6·0<br>— | 0·75<br>— | 1,500<br>— |
| TH21C | Triode Hexode | British 7-pin (31) | 21 | 0·2 | ● 250<br>△ 125 | 70<br>— | 1·5<br>0 | 1·6<br>6·0 | 3·8<br>— | 0·6<br>— | —<br>— |
| TH30C | Triode Heptode | British 7-pin (31) | 29 | 0·2 | ● 250<br>△ 100 | 100<br>— | 2·5<br>0 | 3·25<br>9·5 | 6·0<br>— | 0·75<br>— | 1,500<br>— |
| UCH11 | Triode Hexode | Y. (144) | 20 | 0·1 | ● 200<br>△ 150 | 80<br>— | 2·0<br>0 | 2·5<br>19 | 3·0<br>— | 0·75<br>— | 1,000<br>— |
| UCH21 | Triode Heptode | 88G (88) | 20 | 0·1 | ● 200<br>△ 100 | 100<br>— | 2·0<br>0 | 3·5<br>12 | 6·5<br>— | 0·75<br>— | 1,000<br>— |
| **UCH42** | **Triode Hexode** | **B8A (94)** | **14** | **0·1** | ● 170<br>△ 100 | 70<br>— | 1·85<br>0 | 2·1<br>10 | 2·6<br>— | 0·67<br>— | 1,000<br>8·0 |

● Mixer Section. △ Triode Section.

## DIODES

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va max. (V) | Ia max. (mA) |
|---|---|---|---|---|---|---|
| A82 | Double Diode | V. (129) | 4·0 | 0·65 | 200 | 0·8 |
| **DA90** | **Indirectly-heated Single Diode** | **B7G (113)** | **1·4** | **0·15** | **330 (P.I.V. max.)** | **0·5** |
| EA50 | Single Diode | B3G (118) | 6·3 | 0·15 | 50 | 5·0 |
| EB4 | Double Diode with separate Cathodes | P. (139) | 6·3 | 0·2 | 200 | 0·8 |
| EB34 | Double Diode with separate Cathodes | Octal (58) | 6·3 | 0·2 | 200 | 0·8 |
| EB41 | Double Diode with separate Cathodes | 88A (92) | 6·3 | 0·3 | 150 | 9·0 |

## DIODES—*continued*

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va max. (V) | Ia max. (mA) |
|---|---|---|---|---|---|---|
| **EB91** | **Double Diode with separate Cathodes** .. | B7G (37) | 6·3 | 0·3 | 420 (P.I.V. max.) | 9·0 |
| KB2 | Double Diode .. .. .. .. .. .. | V. (129) | 2·0 | 0·095 | 125 | 0·5 |
| UB41 | Double Diode with separate Cathodes .. .. | B8A (92) | 19 | 0·1 | 150 | 9·0 |
| 2D4A | Double Diode .. .. .. .. .. .. | British 5-pin (8) | 4·0 | 0·65 | 200 | 0·8 |

## TRIODES AND DOUBLE TRIODES

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va (V) | —Vg (V) | Ia (mA) | $\mu$ | gm (mA/V) | ra (K Ω) |
|---|---|---|---|---|---|---|---|---|---|---|
| ACO44 | Directly-heated Output Triode .. .. .. | British 4-pin (3) | 4·0 | 1·0 | 300 | 38 | 50 | 6·0 | 5·0 | 1·2 |
| **DCC90** | **R.F. Double Triode suitable for portable transmitters** | **B7G (114)** | **1·4 / 2·8** | **0·22 / 0·11** | **90** | **2·5** | **3·7** | **15** | **1·8** | **8·3** |
| EC31 | Low Impedance Triode .. .. .. .. .. | Octal (60) | 6·3 | 0·65 | 250 | 16 | 20 | 10·5 | 3·2 | 3·3 |
| EC52 | Low power V.H.F. Oscillator Triode .. .. | B9G (89) | 6·3 | 0·43 | 250 | 2·6 | 10 | 60 | 6·5 | 9·2 |
| EC53 | Low power U.H.F. Oscillator Triode .. .. .. | B3G (120) | 6·3 | 0·25 | 200 | 3·3 | 7·5 | 33 | 4·0 | 11·4 |
| EC54 | Earthed Grid Triode .. .. .. .. .. | B9G (15) | 6·3 | 0·43 | 250 | 1·5 | 10 | 98 | 9·0 | 11·1 |
| EC91 | Earthed Grid Triode .. .. .. .. .. | B7G (59) | 6·3 | 0·3 | 250 | 1·5 | 10 | 100 | 8·5 | 12 |
| ECC31 | Medium Impedance Double Triode .. .. .. | Octal (142) | 6·3 | 0·95 | 250 | 4·6 | 6·0 | 32 | 2·3 | 14 |
| ECC32 | Medium Impedance Double Triode with separate Cathodes .. .. .. .. .. .. | Octal (64) | 6·3 | 0·95 | 250 | 4·6 | 6·0 | 32 | 2·3 | 14 |
| **ECC33** | **High Slope, Low Impedance Double Triode with separate Cathodes** .. .. .. .. | Octal (64) | 6·3 | 0·4 | 250 | 4·0 | 9 | 35 | 3·6 | 9·7 |
| ECC34 | Low Impedance Double Triode with separate Cathodes .. .. .. .. .. .. | Octal (64) | 6·3 | 0·95 | 250 | 16 | 10 | 11·5 | 2·2 | 5·2 |

## TRIODES AND DOUBLE TRIODES—*continued*

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va (V) | −Vg (V) | Ia (mA) | $\mu$ | gm (mA/V) | ra (K Ω) |
|---|---|---|---|---|---|---|---|---|---|---|
| **ECC35** | **High-gain Double Triode with separate Cathodes** | Octal (64) | 6·3 | 0·4 | 250 | 2·5 | 2·3 | 68 | 2·0 | 34 |
| **ECC40** | **Low Microphony Double Triode with separate Cathodes** | B8A (100) | 6·3 | 0·6 | 250 | 5·2 | 6·0 | 30 | 2·7 | 11 |
| **ECC81** | **Double Triode with separate Cathodes for use as Frequency Changer or R.F. Amplifier** | B9A (63) | 6·3<br>12·6 | 0·3<br>0·15 | 170 | 1·5 | 7·0 | 57 | 4·8 | 12 |
| **ECC91** | **Double Triode for use as a R.F. Amplifier or Oscillator** | B7G (80) | 6·3 | 0·45 | 100 | 0·85 | 8·5 | 38 | 5·3 | 7·1 |
| ECF1 | Triode combined with R.F. or I.F. Pentode (for Pentode data see page 28) | P. (143) | 6·3 | 0·2 | 150 | 3·0 | 8·0 | 20 | 2·2 | 9·0 |
| ECL11 | Triode combined with an Output Tetrode (for Tetrode data see page 37) | Y. (145) | 6·3 | 1·0 | 250 | 2·5 | 2·0 | 70 | 2·0 | 35 |
| **ECL80** | **Triode combined with an Output Pentode (for Pentode data see page 37)** | B9A (102) | 6·3 | 0·3 | 100 | 2·3 | 4·0 | 17·5 | 1·4 | 12·5 |
| HL13 | Medium Impedance Triode | P. (44) | 13 | 0·2 | 200 | 3·7 | 5·0 | 40 | 3·3 | 12 |
| HL13C | Medium Impedance Triode | British 7-pin (19) | 13 | 0·2 | 200 | 3·7 | 5·0 | 40 | 3·3 | 12 |
| PM2A | Output Triode | British 4-pin (3) | 2·0 | 0·2 | 135 | 6·0 | 5·0 | 12 | 2·0 | 6·0 |
| PM2HL | Medium Impedance Triode | British 4-pin (3) | 2·0 | 0·1 | 135 | 1·5 | 2·2 | 30 | 1·4 | 21·5 |
| PM202 | Power Triode | British 4-pin (3) | 2·0 | 0·2 | 150 | 14 | 14 | 7 | 3·5 | 2·0 |
| UCL11 | Triode combined with Output Tetrode (for Tetrode data see page 39) | Y. (145) | 60 | 0·1 | 200 | 2·0 | 2·0 | 65 | 2·1 | 30 |
| 354V | Medium Impedance Triode | British 5-pin (9) | 4·0 | 0·65 | 250 | 4·5 | 6·5 | 40 | 3·5 | 11·5 |

## TRIODES WITH DIODES

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va (V) | −Vg1 (V) | Ia (mA) | μ | gm (mA/V) | ra (KΩ) |
|---|---|---|---|---|---|---|---|---|---|---|
| ABC1 | Double Diode Triode | P. (45) | 4·0 | 0·65 | 250 | 7·0 | 4·0 | 27 | 2·0 | 13·5 |
| DAC21 | Single Diode Triode | Octal (132) | 1·4 | 0·025 | 90 | 0 | 0·45 | 40 | 0·3 | 130 |
| DAC32 | Single Diode Triode | Octal (65) | 1·4 | 0·05 | 90 | 0 | 0·15 | 65 | 0·275 | 240 |
| EAC91 | Single Diode Triode with separate Cathode for Diode | B7G (36) | 6·3 | 0·3 | 200 | 2·8 | 7·5 | 36 | 2·8 | 12·8 |
| EBC3 | Double Diode Triode | P. (45) | 6·3 | 0·2 | 250 | 5·5 | 5·0 | 30 | 2·0 | 15 |
| EBC33 | Double Diode Triode | Octal (62) | 6·3 | 0·2 | 250 | 5·5 | 5·0 | 30 | 2·0 | 15 |
| **EBC41** | **Double Diode Triode** | **B8A (97)** | **6·3** | **0·23** | **250** | **3·0** | **1·0** | **70** | **1·3** | **54** |
| KBC1 | Double Diode Triode | P. (153) | 2·0 | 0·115 | 135 | 4·5 | 2·5 | 16 | 1·0 | 16 |
| KBC32 | Double Diode Triode | Octal (61) | 2·0 | 0·05 | 100 | 0 | 2·4 | 25 | 1·2 | 21 |
| TDD2A | Double Diode Triode | British 5-pin (10) | 2·0 | 0·12 | 135 | 1·5 | 1·95 | 30 | 1·2 | 25 |
| TDD4 | Double Diode Triode | British 7-pin (20) | 4·0 | 0·65 | 250 | 7·0 | 4·0 | 27 | 2·0 | 13·5 |
| TDD13C | Double Diode Triode | British 7-pin (20) | 13·0 | 0·2 | 200 | 5·0 | 4·0 | 27 | 2·0 | 13·5 |
| **UBC41** | **Double Diode Triode** | **B8A (97)** | **14·0** | **0·1** | **170** | **1·6** | **1·5** | **70** | **1·65** | **42** |

## OUTPUT PENTODES

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va=Vg2 (V) | −Vg1 (V) | Ia (mA) | Ig2 (mA) | gm (mA/V) | Pout (W) | Ra (KΩ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AL4 | Output Pentode (pa max.=9 W) | P. (46) | 4·0 | 1·75 | 250 | 6·0 | 36 | 40 | 9·0 | 4·5 | 7·0 |
| CL4 | Output Pentode (pa max.=9 W) | P. (48) | 33·0 | 0·2 | 200 | 8·5 | 45 | 6·0 | 8·0 | 4·0 | 4·5 |
| CL33 | Output Pentode (pa max.=9 W) | Octal (70) | 33·0 | 0·2 | 200 | 8·5 | 45 | 6·0 | 8·0 | 4·0 | 4·5 |

## OUTPUT PENTODES—*continued*

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va=Vg2 (V) | −Vg1 (V) | Ia (mA) | Ig2 (mA) | gm (mA/V) | Pout (W) | Ra (KΩ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DL21 | Output Pentode .. .. .. .. | Octal (136) | 1·4 | 0·05 | 120 | 4·8 | 5·0 | 0·9 | 1·4 | 0·27 | 24 |
| DL33 | Output Pentode .. .. .. .. | Octal (69) | 1·4<br>2·8 | 0·1<br>0·05 | 90<br>90 | 90<br>90 | 4·5<br>4·5 | 9·5<br>8·0 | 1·3<br>1·0 | 0·27<br>0·23 | 8·0<br>8·0 |
| DL35 | Output Pentode .. .. .. .. | Octal (66) | 1·4 | 0·1 | 90 | 7·5 | 7·8 | 3·5 | 1·55 | 0·24 | 8·0 |
| DL36 | Output Pentode .. .. .. .. | Octal (66) | 1·4 | 0·1 | 90 | 4·5 | 9·5 | 1·3 | 2·2 | 0·27 | 8·0 |
| DL41 | Output Pentode .. .. .. .. | B8A (137) | 1·4<br>2·8 | 0·1<br>0·05 | 90<br>90 | 3·6<br>3·6 | 8·0<br>6·0 | 1·3<br>0·95 | 2·45<br>2·2 | 0·36<br>0·235 | 11·3<br>15 |
| **DL66** | **Hearing-aid Output Pentode .. ..** | **B5A (121)** | **1·25** | **0·015** | **22·5** | **1·4** | **0·3** | **0·075** | **0·35** | **0·0027** | **75** |
| **DL68** | **Hearing-aid Output Pentode .. ..** | **B5A (121)** | **1·25** | **0·025** | **22·5** | **2·2** | **0·6** | **0·15** | **0·43** | **0·005** | **37·5** |
| DL71 | Hearing-aid Output Pentode .. .. | B8D (16) | 1·25 | 0·025 | 45 | 1·25 | 0·6 | 0·15 | 0·55 | 0·0063 | 100 |
| DL72 | Hearing-aid Output Pentode .. .. | B8D (16) | 1·25 | 0·025 | 45 | 4·5 | 1·25 | 0·4 | 0·5 | 0·0195 | 30 |
| **DL92** | **Output Pentode .. .. .. ..** | **B7G (39)** | 1·4<br>2·8 | 0·1<br>0·05 | 90*<br>90* | 7·0<br>7·0 | 7·4<br>6·1 | 1·4<br>1·1 | 1·57<br>1·42 | 0·27<br>0·235 | 8·0<br>8·0 |
| **DL93** | **Output Pentode suitable for R.F. or A.F. applications** | **B7G (115)** | 1·4<br>2·8 | 0·2<br>0·1 | 150† | 8·4 | 13·3 | 2·2 | 1·9 | 0·7‡ | 8·0 |
| **DL94** | **Output Pentode .. .. .. ..** | **B7G (30)** | 1·4<br>2·8 | 0·1<br>0·05 | 90<br>90 | 4·5<br>4·5 | 9·5<br>7·7 | 2·1<br>1·7 | 2·15<br>2·0 | 0·27<br>0·24 | 10<br>10 |
| DLL21 | Double Output Pentode .. .. .. | Octal (138) | 1·4<br>2·8 | 0·2<br>0·1 | 135<br>135 | 9·4<br>9·5 | 2×8·8<br>2×8·2 | 2×2·3<br>2×2·4 | —<br>— | 1·5<br>1·5 | 15§<br>15§ |
| ECL11 | Output Tetrode (pa max.=9 W) combined with Triode (for Triode data see page 35) | Y. (145) | 6·3 | 1·0 | 250 | 6·0 | 36 | 4·0 | 9·0 | 3·8 | 7·0 |
| **ECL80** | **Output Pentode (pa max.=3·5 W) combined with Triode (for Triode data see page 35) .. .. .. ..** | **B9A (102)** | **6·3** | **0·3** | **170** | **6·7** | **15** | **2·8** | **3·2** | **1·0** | **11** |
| EL2 | Output Pentode (pa max.=8 W) .. .. | P. (48) | 6·3 | 0·2 | 250 | 18 | 32 | 5·0 | 2·8 | 3·6 | 8·0 |

* Vg2=67·5 V. † Vg2=90 V. ‡ Pout=1·2 W as R.F. Power Amplifier at 50 Mc/s (intermittent operation). § Ra-a.

## OUTPUT PENTODES – *continued*

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va=Vg2 (V) | −Vg1 (V) | Ia (mA) | Ig2 (mA) | gm (mA/V) | Pout (W) | Ra (KΩ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EL3 | Output Pentode (pa max.=9 W) .. .. | P. (46) | 6·3 | 0·9 | 250 | 6·0 | 36 | 4·0 | 9·0 | 4·5 | 7·0 |
| EL11 | Output Pentode (pa max.=9 W) .. .. | Y. (146) | 6·3 | 0·9 | 250 | 6·0 | 36 | 4·0 | 9·0 | 4·5 | 7·0 |
| EL12 | Output Pentode (pa max.=18 W) .. .. | Y. (146) | 6·3 | 1·2 | 250 | 7·0 | 72 | 8·0 | 15 | 8·0 | 3·5 |
| EL31 | Output Pentode (pa max.=25 W) .. .. | Octal (73) | 6·3 | 1·4 | 275 | 9·0 | 91 | 11 | 14 | 120* | 10* |
| EL32 | Output Pentode (pa max.=8 W) .. .. | Octal (71) | 6·3 | 0·2 | 250 | 18 | 32 | 5·0 | 2·8 | 3·6 | 8·0 |
| EL33 | Output Pentode (pa max.=9 W) .. .. | Octal (70) | 6·3 | 0·9 | 250 | 6·0 | 36 | 4·0 | 9·0 | 4·5 | 7·0 |
| EL34 | Output Pentode (pa max.=25 W) .. .. | Octal (149) | 6·3 | 1·5 | 250 | 13·5 | 100 | 14 | 11 | 12 | 2·0 |
| EL35 | Output Pentode (pa max.=18 W) .. .. | Octal (70) | 6·3 | 1·35 | 250 | 15·5 | 72 | 8·0 | 5·0 | 6·0 | 2·5 |
| **EL37** | **Output Pentode (pa max.=25 W) ..** | **Octal (70)** | **6·3** | **1·4** | **250** | **13·5** | **100** | **13·5** | **11** | **69*** | **3·25*** |
| **EL38** | **Line Time Base Output Pentode (pa max.=25 W)** | **Octal (73)** | **6·3** | **1·4** | **275** | **9·0** | **91** | **11** | **14** | **va(pk) max.= 8 KV** | |
| **EL41** | **Output Pentode (pa max.=9 W) ..** | **B8A (96)** | **6·3** | **0·7** | **250** | **7·0** | **36** | **5·2** | **10** | **4·2** | **7·0** |
| **EL42** | **Output Pentode (pa max.=6 W) ..** | **B8A (96)** | **6·3** | **0·2** | **225** | **10·5** | **26** | **4·1** | **3·2** | **2·5** | **9·0** |
| §EL81 | **Line Time Base Output Pentode (pa max.=8 W)** | **B9A (122)** | **6·3** | **1·05** | **250** | **38·5** | **32** | **2·4** | **4·6** | **va(pk) max.= 7 KV** | |
| EL91 | Output Pentode (pa max.=4 W) .. .. | B7G (78) | 6·3 | 0·2 | 250 | 12·5 | 16 | 2·4 | 2·6 | 1·4 | 16 |
| KL4 | Output Pentode .. .. .. .. | P. (156) | 2·0 | 0·15 | 135 | 5·0 | 7·0 | 1·1 | 2·1 | 0·44 | 19 |
| KL35 | Output Pentode .. .. .. .. | Octal (66) | 2·0 | 0·15 | 135 | 4·8 | 5·0 | — | 2·2 | 0·31 | 20 |
| KLL32 | Double Output Pentode .. .. .. | Octal (84) | 2·0 | 0·3 | 120 | 10·2 | 3·3 | — | 2·6† | 0·94 | 16 |
| PenA4 | Output Pentode (pa max.=9 W) .. .. | 8ritish 7-pin (25) | 4·0 | 1·95 | 250 | 5·8 | 36 | 5·0 | 9·5 | 3·8 | 8·0 |
| PenB4 | Output Pentode (pa max.=18 W) .. .. | British 7-pin (25) | 4·0 | 2·1 | 250‡ | 12 | 72 | 7·0 | 8·5 | 8·8 | 3·5 |

* Two valves In push-pull (fixed bias). † gm at Va=Vg2=100 V, Vg1=0 V. ‡ Vg2=275 V. § Provisional information.

## OUTPUT PENTODES—*continued*

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va=Vg2 (V) | −Vg1 (V) | Ia (mA) | Ig2 (mA) | gm (mA/V) | Pout (W) | Ra (KΩ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pen4VA | Output Pentode (pa max.=9 W) .. .. | British 5- or 7-pin (12 or 25) | 4·0 | 1·35 | 250 | 19·5 | 36 | 3·0 | 2·8 | 3·8 | 6·0 |
| Pen36C | Output Pentode (pa max.=9 W) .. .. | British 7-pin (25) | 33 | 0·2 | 200 | 8·5 | 45 | 6·0 | 8·0 | 4·0 | 4·5 |
| PL33 | Output Pentode (pa max.=9 W) .. .. | Octal (70) | 19 | 0·3 | 225 | 5·3 | 32 | 3·4 | 9·0 | 3·3 | 7·0 |
| PL38 | Line Time Base Output Pentode (pa max.=25 W) | Octal (73) | 30 | 0·3 | 200 | 5·5 | 75 | 9·0 | 13·5 | va(pk) max=8 KV | |
| **PL81** | **Line Time Base Output Pentode (pa max.=8 W)** | **B9A (122)** | **21·5** | **0·3** | **170** | **22** | **45** | **3·0** | **6·2** | **va(pk) max.=7 KV** | |
| **PL82** | **Output Pentode (pa max.=9 W) ..** | **B9A (123)** | **16·5** | **0·3** | **170** | **10·4** | **53** | **10** | **9·0** | **4·0** | **3·0** |
| **PL83** | **Video Output Pentode (pa max.=9 W)** | **B9A (105)** | **15** | **0·3** | **170** | **2·3** | **36** | **5·0** | **10** | **Vout(pk) into CRT cathode=70 V at Vb=170 V** | |
| PM22A | Output Pentode .. .. .. .. | British 5-pin (11) | 2·0 | 0·15 | 135 | 4·5 | 5·6 | — | 2·2 | 0·34 | 19 |
| PM22D | Output Pentode .. .. .. .. | British 5-pin (11) | 2·0 | 0·3 | 135 | 2·4 | 5·0 | 0·8 | 3·0 | 0·3 | 24 |
| PM24A | Output Pentode .. .. .. .. | British 5-pin (11) | 4·0 | 0·275 | 300* | 22·5 | 20 | — | 1·7 | 2·8 | 15 |
| PM24M | Output Pentode (pa max.=7·5 W).. .. | British 5-pin (11) | 4·0 | 1·1 | 250 | 17 | 30 | 5·6 | 3·0 | 2·8 | 7·0 |
| QP22B | Double Output Pentode .. .. .. | British 7-pin (35) | 2·0 | 0·3 | 135 | 11·7 | 3·8 | 0·5 | — | 1·33 | 14·7 |
| UCL11 | Output Tetrode (pa max.=9 W) combined with Triode (for Triode data see page 35) | Y. (145) | 60 | 0·1 | 200 | 8·5 | 45 | 6·0 | 9·0 | 4·0 | 4·5 |
| **UL41** | **Output Pentode (pa max.=9 W) ..** | **B8A (96)** | **45** | **0·1** | **170** | **10·4** | **53** | **10** | **9·5** | **4·0** | **3·0** |

* Vg2=200 V.

## OUTPUT PENTODES WITH DIODES

| TYPE | DESCRIPTION | BASE | Vh (V) | Ih (A) | Va=Vg2 (V) | −Vg1 (V) | Ia (mA) | Ig2 (mA) | gm (mA/V) | Pout (W) | Ra (KΩ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ABL1 | Double Diode Output Pentode (pa max.=9 W) .. | P. (50) | 4·0 | 2·4 | 250 | 6·0 | 36 | 4·0 | 9·0 | 4·5 | 7·0 |
| CBL1 | Double Diode Output Pentode (pa max.=9 W) .. | P. (50) | 44 | 0·2 | 200 | B·5 | 45 | 6·0 | B·0 | 4·0 | 4·5 |
| CBL31 | Double Diode Output Pentode (pa max.=9 W) .. | Octal (75) | 44 | 0·2 | 200 | B·5 | 45 | 6·0 | B·0 | 4·0 | 4·5 |
| EBL1 | Double Diode Output Pentode (pa max.=9 W) .. | P. (50) | 6·3 | 1·2 | 250 | 6·0 | 36 | 5·0 | 9·5 | 4·3 | 7·0 |
| EBL21 | Double Diode Output Pentode (pa max.=11 W).. | BBG (B7) | 6·3 | 0·B | 250 | 6·0 | 36 | 5·0 | 9·0 | 4·5 | 7·0 |
| EBL31 | Double Diode Output Pentode (pa max.=9 W) .. | Octal (75) | 6·3 | 1·2 | 250 | 6·0 | 36 | 5·0 | 9·5 | 4·3 | 7·0 |
| Pen4DD | Double Diode Output Pentode (pa max.=9 W) .. | British 7-pin (29) | 4·0 | 2·25 | 250 | 6·0 | 36 | 5·0 | 9·5 | 4·3 | 7·0 |
| UBL1 | Double Diode Output Pentode (pa max.=11 W).. | Octal (157) | 55 | 0·1 | 200 | 11·5 | 55 | 11 | B·5 | 5·2 | 3·5 |
| UBL21 | Double Diode Output Pentode (pa max.=11 W).. | BBG (B7) | 55 | 0·1 | 200 | 13 | 55 | 9·5 | 8·0 | 4·B | 3·5 |

## NONODE

| TYPE | DESCRIPTION | BASE | Vh (V) | Ih (A) | TYPICAL OPERATION | | | |
|---|---|---|---|---|---|---|---|---|
| EQB0 | Nonode for use as F.M. Detector and Limiter | B9A (151) | 6·3 | 0·2 | Vb | 170 V | Vin(g3) r.m.s. | 12 V |
| | | | | | Vg2+g4+g6 | 20 V | Vin(g5) r.m.s. | 12 V |
| | | | | | Vg5 | −4 V | Phase angle between signals on g3 and g5 | = 90° |
| | | | | | Vg3 | −4 V | | |
| | | | | | Vg1 | 0 V | Ra | 0·33 MΩ |
| | | | | | Ia | 0·2B mA | | |
| | | | | | Ig2+g4+g6 | 1·5 mA | | |
| | | | | | Ig3 | 0·09 mA | | |
| | | | | | Ig5 | 0·03 mA | | |
| | | | | | ra | 5·0 MΩ | | |

## TUNING INDICATORS

| TYPE | DESCRIPTION | BASE | Vh (V) | Ih (A) | Va (V) | −Vg1 (V) | It (mA) | Optimum Load (MΩ) |
|---|---|---|---|---|---|---|---|---|
| EFM1 | Tuning Indicator combined with A.F. Pentode .. | P. (148) | 6·3 | 0·2 | 250 | 2—20 | 0·65 | 0·13 |
| EM1 | Tuning Indicator .. .. .. .. .. | P. (150) | 6·3 | 0·2 | 250 | 0—5 | 0·13 | 2·0 |
| EM4 | Dual Sensitivity Tuning Indicator .. .. .. | P. (51) | 6·3 | 0·2 | 250<br>250 | 0—16<br>0—5 | 0·75 | 1·0* |
| **EM34** | **Dual Sensitivity Tuning Indicator .. ..** | **Octal (76)** | **6·3** | **0·2** | **250**<br>**250** | **0—16**<br>**0—5** | **0·75** | **1·0*** |
| UM4 | Dual Sensitivity Tuning Indicator .. .. .. | Octal (159) | 12·6 | 0·1 | 200<br>200 | 0—12·5<br>0—4·2 | 1·4 | 1·0* |
| UM34 | Dual Sensitivity Tuning Indicator .. .. .. | Octal (76) | 12·6 | 0·1 | 200<br>200 | 0—12·5<br>0—4·2 | 1·4 | 1·0* |

* Each Anode.



## RECTIFIERS

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va max. (V r.m.s.) | Iout max. (mA) |
|---|---|---|---|---|---|---|
| AZ1 | Directly Heated Full Wave Rectifier .. .. | P. (43) | 4·0 | 1·1 | 2×300 | 100 |
| AZ4 | Directly Heated Full Wave Rectifier .. .. | P. (43) | 4·0 | 2·3 | 2×300 | 200 |
| AZ11 | Directly Heated Full Wave Rectifier .. .. | Y. (130) | 4·0 | 1·1 | 2×300 | 100 |
| AZ12 | Directly Heated Full Wave Rectifier .. .. | Y. (130) | 4·0 | 2·3 | 2×300 | 200 |
| AZ31 | Directly Heated Full Wave Rectifier .. .. | Octal (55) | 4·0 | 1·1 | 2×300 | 100 |
| AZ41 | Directly Heated Full Wave Rectifier .. .. | B8A (131) | 4·0 | 0·72 | 2×300 | 70 |
| CY1 | Indirectly Heated Half Wave Rectifier .. .. | P. (42) | 20 | 0·2 | 250 | 120 |
| CY31 | Indirectly Heated Half Wave Rectifier .. .. | Octal (53) | 20 | 0·2 | 250 | 120 |
| DW2 | Directly Heated Full Wave Rectifier .. .. | British 4-pin (1) | 4·0 | 1·0 | 2×250 | 60 |

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va max. (V r.m.s.) | Iout max. (mA) |
|---|---|---|---|---|---|---|
| DW4/350 | Directly Heated Full Wave Rectifier .. .. | British 4-pin (1) | 4·0 | 2·0 | 2×350 | 120 |
| DW4/500 | Directly Heated Full Wave Rectifier .. .. | British 4-pin (1) | 4·0 | 2·0 | 2×500 | 120 |
| **EY51** | **Indirectly Heated H.V. Rectifier suitable for C.R.T., E.H.T. supplies .. ..** | **Wired-in B2A (119)** | **6·3** | **0·09** | **5,000** | **3·0** |
| | | | **For pulsed input:— P.I.V. max. = 17 KV** | | **Iout max. = 0·35 mA ik(pk) max. = 80 mA** | |
| EY91 | Indirectly Heated Half Wave Rectifier .. .. | B7G (54) | 6·3 | 0·42 | 250 | 75 |
| EZ2 | Indirectly Heated Full Wave Rectifier .. .. | P. (152) | 6·3 | 0·4 | 2×350 | 60 |
| EZ35 | Indirectly Heated Full Wave Rectifier .. .. | Octal (56) | 6·3 | 0·6 | 2×325 | 70 |
| **EZ40** | **Indirectly Heated Full Wave Rectifier .. .** | **B8A (5)** | **6·3** | **0·6** | **2×350** | **90** |
| **EZ41** | **Indirectly Heated Full Wave Rectifier .. .** | **B8A (5)** | **6·3** | **0·4** | **2×250** | **60** |
| FW4/500 | Directly Heated Full Wave Rectifier .. .. | British 4-pin (1) | 4·0 | 3·0 | 2×500 | 250 |
| FW4/800 | Directly Heated Full Wave Rectifier .. .. | British 4-pin (1) | 4·0 | 3·0 | 2×850 | 125 |
| **GZ32** | **Indirectly Heated Full Wave Rectifier .. .** | **Octal (57)** | **5·0** | **2·3** | **2×300** | **300** |
| HVR2 | Indirectly Heated Half Wave Rectifier .. .. | British 4-pin (2) | 4·0 | 0·65 | 6,000 | 3·0 |
| HVR2A | Indirectly Heated Half Wave Rectifier .. .. | British 4-pin (2) | 2·0 | 1·5 | 6,000 | 3·0 |
| IW4/350 | Indirectly Heated Full Wave Rectifier .. .. | British 4-pin (7) | 4·0 | 2·0 | 2×350 | 120 |
| IW4/500 | Indirectly Heated Full Wave Rectifier .. .. | British 4-pin (7) | 4·0 | 2·5 | 2×500 | 120 |
| PY31 | Indirectly Heated Half Wave Rectifier .. .. | Octal (53) | 17 | 0·3 | 250 | 125 |
| **PY80** | **Indirectly Heated Booster Diode for use in Energy Recovery Circuits .. ..** | **B9A (124)** | **19** | **0·3** | | |
| | | | **P.I.V. max. = 4 KV ia(pk) max. = 400 mA** | | **Ia(av) max. = 180 mA vh-k(pk) max. = 650 V** | |
| ***PY81** | **Indirectly Heated Booster Diode for use in Energy Recovery Circuits .. ..** | **B9A (185)** | **17** | **0·3** | | |
| | | | **P.I.V. max. = 4·5 KV ia(pk) max. = 450 mA** | | **Ia(av) max. = 150 mA vh-k(pk) max. = 4·5 KV** | |

* Provisional Information.

## RECTIFIERS—*continued*

| TYPE | DESCRIPTION | BASE | Vh (V) | Ih (A) | Va max. (V r.m.s.) | Iout max. (mA) |
|---|---|---|---|---|---|---|
| **PY82** | **Indirectly Heated Half Wave Rectifier** .. | **B9A (124)** | **19** | **0·3** | **250** | **180** |
| PZ30 | Indirectly Heated Rectifier with two separate Half Wave Sections, suitable for use as Half Wave or Voltage Doubling Rectifier .. .. | Octal (17) | 52 | 0·3 | 240 | 200* |
| UR1C | Indirectly Heated Half Wave Rectifier .. .. | British 5-pin (6) | 20 | 0·2 | 250 | 75 |
| UR3C | Indirectly Heated Multiple Rectifier .. .. | British 7-pin (18) | 30 | 0·2 | 2×250 | 120 |
| UY1N | Indirectly Heated Half Wave Rectifier .. .. | Octal (160) | 50 | 0·1 | 250 | 140 |
| UY11 | Indirectly Heated Half Wave Rectifier .. .. | Y. (161) | 50 | 0·1 | 250 | 140 |
| UY21 | Indirectly Heated Half Wave Rectifier .. .. | B8G (85) | 50 | 0·1 | 250 | 140 |
| **UY41** | **Indirectly Heated Half Wave Rectifier** .. | **B8A (14)** | **31** | **0·1** | **250** | **100** |

* As voltage doubler Vout = 480 V.

## VOLTAGE REFERENCE AND STABILIZING TUBES

| TYPE | DESCRIPTION | BASE | V Ignition max. (V) | V Burning (V) | I max. (mA) | I min. (mA) | I Quiescent (mA) | A.C. Resistance max. (Ω) |
|---|---|---|---|---|---|---|---|---|
| **85A1** | **Neon-filled Voltage Reference Tube** | **B8G (127)** | **125** | **83–87** | **8·0** | **1·0** | **4·5** | **450** |
| **85A2** | **Neon-filled Voltage Reference Tube** | **B7G (128)** | **125** | **83–87** | **10** | **1·0** | **6·0** | **450** |
| ***150B2** | **Inert-gas-filled Voltage Stabilizer** .. | **B7G (186)** | **180** | **143–157** | **15** | **5·0** | **10** | **500** |
| 4687 | Neon-filled Voltage Stabilizer .. .. | P. (49) | 130 | 90–110 | 40 | 10 | 20 | 250 |
| 4687A | Neon-filled Voltage Stabilizer .. .. | British 4-pin (23) | 130 | 90–110 | 40 | 10 | 20 | 250 |
| 7475 | Neon-filled Voltage Stabilizer .. .. | British 4-pin (23) | 140 | 90–110 | 8 | 1·0 | 4·0 | 300 |
| 13201A | Neon-filled Voltage Stabilizer .. .. | British 4-pin (23) | 135 | 90–110 | 200 | 15 | 100 | 80 |

* Provisional information.

| TYPE | DESCRIPTION | LUMINESCENT COLOUR | PER-SISTENCE | BASE | Vh (V) | Ih (A) | MAXIMUM FINAL† ANODE VOLTAGE | DEFLECTION SENSITIVITY |
|---|---|---|---|---|---|---|---|---|
| DB4-1<br>DG4-1<br>DP4-1 | 1¾" Electrostatic Oscillograph Tubes for symmetrical operation | Blue<br>Green<br>Blue with Green afterglow | Short<br>Medium<br>Long | B9G (162) | 6·3 | 0·3 | 1,000 | Sx = 0·13 mm/V<br>Sy = 0·21 mm/V |
| DB4-2<br>DG4-2<br>DP4-2 | 1¾" Electrostatic Oscillograph Tubes X plates suitable for asymmetrical operation | Blue<br>Green<br>Blue with Green afterglow | Short<br>Medium<br>Long | B9G (162) | 6·3 | 0·3 | 1,000 | Sx = 0·13 mm/V<br>Sy = 0·21 mm/V |
| DB7-5<br>DG7-5<br>DR7-5 | 2½" Electrostatic Oscillograph Tubes for symmetrical operation | Blue<br>Green<br>Blue with Green afterglow | Short<br>Medium<br>Long | B9G (162) | 6·3 | 0·3 | 1,000 | Sx = 0·16 mm/V<br>Sy = 0·26 mm/V |
| DB7-6<br>DG7-6<br>DR7-6 | 2½" Electrostatic Oscillograph Tubes. X plates suitable for asymmetrical operation | Blue<br>Green<br>Blue with Green afterglow | Short<br>Medium<br>Long | B9G (162) | 6·3 | 0·3 | 1,000 | Sx = 0·16 mm/V<br>Sy = 0·26 mm/V |
| *DB13-2<br>*DG13-2<br>*DP13-2 | 5" Electrostatic Oscillograph Tubes with post-deflection accelera-tor. Suitable for symmetrical operation | Blue<br>Green<br>Blue with Green afterglow | Short<br>Medium<br>Long | B14A (163) | 6·3 | 0·3 | 2,500 (Va4 max. = 5 KV) | Sx = 0·3 mm/V<br>Sy = 0·35 mm/V (with acceleration) |
| ECR30 | 3" Electrostatic Oscillograph Tube for symmetrical operation | Green | Medium | B12B (165) | 4·0 | 1·0 | 1,000 | Sx = 0·21 mm/V<br>Sy = 0·21 mm/V |
| ECR35<br>ECR35P | 3½" Electrostatic Oscillograph Tubes for symmetrical or asymmetrical operation | Green<br>Blue with Green afterglow | Medium<br>Long | B12D (166) | 4·0 | 1·0 | 2,500 | Sx = 0·3 mm/V<br>Sy = 0·65 mm/V |
| ECR60 | 6" Electrostatic Oscillograph Tube for symmetrical or asymmetrical operation | Green | Medium .. | B12D (166) | 4·0 | 1·0 | 2,500 | Sx = 0·3 mm/V<br>Sy = 0·575 mm/V |

* Provisional information.

† Design centre ratings.

## CATHODE RAY TUBES—*continued*

| TYPE | DESCRIPTION | LUMINESCENT COLOUR | PER-SISTENCE | BASE | Vh (V) | Ih (A) | MAXIMUM FINAL† ANODE VOLTAGE | DEFLECTION SENSITIVITY |
|---|---|---|---|---|---|---|---|---|
| *MF13-1 | 5" Magnetic Radar Tube with metal-backed screen | Orange with Orange afterglow | Long | Octal (176) | 6·3 | 0·3 | 11,000 (absolute) | $\frac{0{\cdot}3\ P.cL}{\sqrt{Va2}}$ cm./gauss<br>Where—<br>P is the distance of effective centre of the deflector coils from the screen centre.<br>L is the length in cm. of the electron path through the field of the deflector coils.<br>c is a correction factor depending upon the shape of the coils, normally about 0·5. |
| *MF31-22 | 12" Magnetic Radar Tube with metal-backed screen | Orange with Orange afterglow | Long | B12A (116) | 6·3 | 0·3 | 12,000 (absolute) | |
| MW6-2 | 2½" Magnetic Projection Tube with metal-backed screen | White | Medium | V (117) | 6·3 | 0·3 | 25,000 | |
| MW31-16 | 12" Magnetic Television Tube incorporating an ion trap and with external conductive coating | White | Medium | B12A (116) | 6·3 | 0·3 | 9,000 | |
| *MW36-22 | 14" Rectangular Television Tube incorporating an ion trap and with external conductive coating | White | Medium | B12A (116) | 6·3 | 0·3 | 14,000 | |
| MW41-1 | 16" Metal Cone Television Tube incorporating an ion trap | White | Medium | B12A (116) | 6·3 | 0·3 | 14,000 | |

* Provisional information. † Design centre ratings unless otherwise specified.

## THYRATRONS

| TYPE | DESCRIPTION | BASE | Vh (V) | Ih (A) | va(pk) max. (KV) | P.I.V. max. (KV) | ia(pk) max. (A) | Ia max. (A) | VALVE VOLTAGE DROP (V) |
|---|---|---|---|---|---|---|---|---|---|
| EN31 | Helium-filled Triode .. .. | Octal (83) | 6·3 | 1·3 | 1·0 | 1·5 | 0·75 | 0·01 | 33 |
| *ME1503 | Hydrogen-filled Triode .. | B4D (175) | 6·3 | 3·75 | 8·0 | 8·0 | 60 | 0·015 | — |

* Provisional information.

## THYRATRONS—*continued*

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | va(pk) max. (KV) | P.I.V. max. (KV) | ia(pk) max. (A) | Ia max. (A) | VALVE VOLTAGE DROP (V) |
|---|---|---|---|---|---|---|---|---|---|
| MT17 | Mercury Vapour Triode .. | 4-pin UX (177) | 2·5 | 5·0 | 2·5 | 5·0 | 2·0 | 0·5 | 16 |
| MT57 | Mercury Vapour Triode .. | 4-pin UX (178) | 5·0 | 4·5 | 1·0 | 1·0 | 15 | 2·5 | 16 |
| *MT105 | Mercury Vapour Tetrode | B4D (179) | 5·0 | 10 | 2·5 | 2·5 | 40 | 6·4 | 16 |
| *MT5544 | Inert-gas-filled Triode .. | B4D (180) | 2·5 | 12 | 1·5 | 1·5 | 40 | 3·2 | 16 |
| *MT5545 | Inert-gas-filled Triode .. | B4D (180) | 2·5 | 21 | 1·5 | 1·5 | 80 | 6·4 | 16 |
| 2D21 | Inert-gas-filled miniature Tetrode .. .. .. | B7G (181) | 6·3 | 0·6 | 0·65 | 1·3 | 0·5 | 0·1 | 8 |
| 1267 | Cold Cathode Gas-filled Triode .. .. .. | Octal (184) | Cold Cathode | | 0·225 | — | 0·1 | 0·025 | 70 |

* Provisional information.

## FLASH-TUBES

| TYPE | DESCRIPTION | BASE | MAX. ENERGY OF DISCHARGE (Joules) | ANODE VOLTAGE RANGE (KV) | MIN. TRIGGER VOLTAGE (KV) | APPROX. FLASH DURATION ($\mu$ secs.) | PEAK LIGHT OUTPUT (Megalumens) | INTEGRATED LIGHT OUTPUT (Lumen-secs.) |
|---|---|---|---|---|---|---|---|---|
| LSD2 | Microsecond Flash-Tube | Edison Screw (167) | 35 | 7-10 | 8 | 1·0 (peak) | 100 | 1,500 |
| LSD3 | Flash-Tube for portable equipment | 4-pin UX (110) | 100 | 2-2·7 | 4 | 100 | 35 | 3,000 |
| LSD3A | | 3-pin. Samp. (111) | | | | | | |
| LSD4 | Flash-Tube for studio photography | 3-pin special (112) | 400 | 2-2·7 | 4 | 300 | 66 | 26,000 |

**FLASH-TUBES**—*continued*

| TYPE | DESCRIPTION | BASE | MAX. ENERGY OF DISCHARGE (Joules) | ANODE VOLTAGE RANGE (KV) | MIN. TRIGGER VOLTAGE (KV) | APPROX. FLASH DURATION ($\mu$ secs.) | PEAK LIGHT OUTPUT (Megalumens) | INTEGRATED LIGHT OUTPUT (Lumen-secs.) |
|---|---|---|---|---|---|---|---|---|
| **LSD5** | **Flash-Tube for studio set, stage, and commercial colour photography** | **3-pin special (112)** | **1,000** | **2-2·7** | **6** | **500** | **80** | **40,000** |
| **LSD7** | **Flash-Tube for studio or portable equipment** | **4-pin UX (110)** | **200** | **2-2·7** | **5** | **200** | **44** | **7,000** |
| ***LSD8** | **Stroboscopic Flash-Tube** | **4-pin UX (168)** | **30W†** | **2-2·7** | **4** | **50** | **0·06** | **—** |
| *LSD9 | Quartz Flash-Tube for ultraviolet operation | 4-pin UX (110) | 1,000 | 2–2·7 | 4 | 600 | 40 | 25,000 |
| LSD10 | Flash-Tube for stage, studio set, and colour photography | Wired-in | 10,000 | 2·5–4 | 17 | 3,000 | 250 | 500,000 |
| LSD12 | 9" Linear Glass Tube | Wired-in | 100 | 2–2·7 | External trigger required | 80 | 60 | 4,500 |
| LSD13 | 18" Linear Glass Tube | Wired-in | 600 | 2–2·7 | " | 400 | 65 | 27,000 |
| LSD14 | 24" Linear Glass Tube | Wired-in | 2,500 | 2–2·7 | " | 1,300 | 70 | 150,000 |
| LSD15 | 12" Linear Glass Tube | Wired-in | 200 | 2–2·7 | " | 200 | 50 | 8,000 |
| LSD16 | 9" Linear Quartz Tube | Wired-in | 500 | 2–2·7 | " | 150 | 140 | 16,000 |
| LSD17 | 12" Linear Quartz Tube | Wired-in | 1,000 | 2–2·7 | " | 500 | 100 | 45,000 |
| LSD18 | 18" Linear Quartz Tube | Wired-in | 2,500 | 2–2·7 | " | 1,200 | 43 | 95,000 |

* Provisional information. † Mean power dissipation. Max. repetition rate 500 c/s (30,000 r.p.m.).

| TYPE | DESCRIPTION | BASE | MAX. ANODE SUPPLY VOLTAGE (V) | MAX. DARK CURRENT AT MAX. ANODE SUPPLY VOLTAGE ($\mu$A) | MAX. CATHODE CURRENT ($\mu$A) | SENSITIVITY* ($\mu$A/Lumen) | MAX. GAS AMPLIFICATION FACTOR | PROJECTED CATHODE AREA (sq. cm.) |
|---|---|---|---|---|---|---|---|---|
| 20AV | Vacuum Photocell with caesium/antimony cathode | B8G (106) | 150 | 0·05 | 10 | 45 | — | 11 |
| 20CG | Gas-filled Photocell with caesium/oxidised silver cathode | B8G (107) | 90 | 0·1 | 5·0 | 150 | 10 | 6·7 |
| 20CV | Vacuum Photocell with caesium/oxidised silver cathode | B8G (107) | 150 | 0·05 | 20 | 25 (Va=100 V) | — | 6·7 |
| 52CG | Gas-filled Photocell with caesium/oxidised silver cathode | British 4-pin (125) | 90 | 0·1 | 3·0 | 125 | 10 | 4·0 |
| 55CG | Gas-filled Photocell with caesium/oxidised silver cathode | B3A (American Pee-Wee) (126) | 90 | 0·1 | 2·0 | 125 | 10 | 2·2 |
| 57CV | Photometric Cell with caesium/oxidised silver cathode | British 4-pin (182) | 100 | $10^{-4}$ (Va=50 V) | 0·5 | 13 (Va=50 V) | — | 4·5 |
| 58CG | Gas-filled Photocell with caesium/oxidised silver cathode for end-on incidence of illumination | Wired-in (183) | 90 | 0·1 | 1·5 | 100 | 9 | 1·1 |
| 58CV | Vacuum Photocell with caesium/oxidised silver cathode for end-on incidence of illumination | Wired-in (183) | 100 | 0·05 | 3·0 | 20 (Va=50 V) | — | 1·1 |

* Sensitivity measured at max. anode supply voltage with the whole cathode area illuminated by a lamp of colour temperature 2700° K and with a series resistor of 1 M Ω

## PHOTOCELLS—*continued*

| TYPE | DESCRIPTION | BASE | MAX. ANODE SUPPLY VOLTAGE (V) | MAX. DARK CURRENT AT MAX. ANODE SUPPLY VOLTAGE ($\mu$A) | MAX. CATHODE CURRENT ($\mu$A) | SENSITIVITY* ($\mu$A/Lumen) | MAX. GAS AMPLIFICATION FACTOR | PROJECTED CATHODE AREA (sq. cm.) |
|---|---|---|---|---|---|---|---|---|
| 90AG | Gas-filled Photocell with caesium/antimony cathode | B7G (108) | 90 | 0·1 | 2·5 | 150 | 7 | 4·0 |
| 90AV | Vacuum Photocell with caesium/antimony cathode | B7G (108) | 100 | 0·05 | 5·0 | 45 | — | 4·0 |
| 90CG | Gas-filled Photocell with caesium/oxidised silver cathode | B7G (109) | 90 | 0·1 | 2·0 | 125 | 10 | 3·1 |
| 90CV | Vacuum Photocell with caesium/oxidised silver cathode | B7G (109) | 100 | 0·05 | 10 | 20 (Va=50V) | — | 3·1 |

* Sensitivity measured at max. anode supply voltage with the whole cathode area illuminated by a lamp of colour temperature 2700°K and with a series resistor of 1 MΩ.

NOTE.—Caesium/antimony cathode is particularly sensitive to daylight and bluish light.
Caesium/oxidised silver cathode is particularly sensitive to incandescent light and to near infra-red radiation.

## IMAGE CONVERTERS

| TYPE | DESCRIPTION | BASE NO. | PHOTO-CATHODE | SENSITIVITY OF PHOTOCATHODE ($\mu$A/Lumen) | LUMINESCENT SCREEN | Va-k max. (KV) | LINEAR MAGNIFICATION OF IMAGE | SCREEN RESOLUTION (Lines/cm.) |
|---|---|---|---|---|---|---|---|---|
| *ME1200AA | Magnetically focused Image-converter sensitive to daylight and bluish light | 171 | Caesium/Antimony | 20 | Blue Short persistence | 6 | 3·7 | 200 |

* Provisional information.

## IMAGE CONVERTERS—*continued*

| TYPE | DESCRIPTION | BASE NO. | PHOTO-CATHODE | SENSITIVITY OF PHOTOCATHODE (μA/Lumen) | LUMIN-ESCENT SCREEN | Va-k max. (KV) | LINEAR MAGNIFI-CATION OF IMAGE | SCREEN RESOLUTION (Lines/cm.) |
|---|---|---|---|---|---|---|---|---|
| *ME1201AA | Grid controlled magnetically focused Image-converter sensitive to daylight and bluish light | 172 | Caesium/ Antimony | 20<br>For typical operation, Vg-k = 3 KV<br>For extinction of image Vg-k = −20 V | Blue Short persistence | 6 | 2·5-3·5 | 200 |
| *ME1202CA | Magnetically focused Image-converter sensitive to near infra-red radiation | 173 | Caesium/ oxidised silver | 15 | Blue short persistence | 6 | 1 | 200 |

Variants of these tubes with different photocathodes and luminescent screens are also available, and are distinguished by the last two letters of the type number. * Provisional information.



## U.H.F. VALVES

| TYPE | DESCRIPTION | BASE NO. | Vh (V) | Ih (A) | CHARACTERISTICS |
|---|---|---|---|---|---|
| ME1001 | Disc Seal Triode for use as a common-grid earthed-anode concentric line oscillator | 169 | 6·3 | 0·4 | Va = 250 V<br>Vg = −3·5 V<br>Ia = 20 mA<br>μ = 30<br>gm = 6 mA/V |
| *ME1005 | Disc Seal Triode for use as a voltage amplifier | 169 | 6·3 | 0·4 | Va = 250 V<br>Vg = −1·3 V<br>Ia = 10 mA<br>μ = 70<br>gm = 6·5 mA/V |

* Provisional Information.

## U.H.F. VALVES—*continued*

| TYPE | DESCRIPTION | BASE NO. | Vh (V) | Ih (A) | CHARACTERISTICS |
|---|---|---|---|---|---|
| *ME1100 | Mechanically Tuned Reflex Klystron for use as a 3 cm. local oscillator | — | 6·3 | 0·6 | Frequency Range = 8,500-9,660 Mc/s.<br>Max. resonator voltage = 350 V<br>Max. resonator current = 30 mA<br>Max. reflector voltage = −350 V<br>Min. power output = 20 mW<br>Base:—Octal with coaxial line at pin 4 |
| *ME1101 | 3 cm. Fixed Frequency Packaged Magnetron | — | 6·3 | 0·5 | Frequency range = 9,345-9,405 Mc/s.<br>Va max. = 5·7 KV, Ia max. = 7 A } pulsed<br>Max. duty cycle = 0·001<br>Max. pulse length = 2·5 $\mu$ sec.<br>Max. power output = 14 KW |

* Provisional information.



## ACCELEROMETER TUBE

| TYPE | DESCRIPTION | BASE | Vh (V) | Ih (A) | CHARACTERISTICS |
|---|---|---|---|---|---|
| DDR100 | Accelerometer Double Diode | B8G (164) | 6·3 | 0·6 | Va max. = 10 V †Sensitivity = 7·5 mv/g Max. acceleration = 100 g |

† Across resistance bridge.

## ELECTROMETERS

| TYPE | DESCRIPTION | BASE | Vf or Vh (V) | If or Ih (A) | Va (V) | Ig2 (V) | −Vg1 (V) | Ia ($\mu$A) | Ig1 (A) | gm ($\mu$A/V) | $\mu$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ME1400 | Electrometer Pentode | Octal (72) | 4·5 | 0·16 | △45<br>●45 | 45<br>— | 2·0<br>2·0 | 80<br>100 | $<10^{-11}$<br>$<10^{-11}$ | 240<br>300 | —<br>20 |
| *ME1401 | Subminiature Electrometer Triode | Wired-in (174) | 1·25 | 0·013 | 9 | — | 2·5 | 100 | $<12.5\times10^{-14}$ | 80 | 1·7 |

* Provisional Information. △ Pentode connected. ● Triode connected.

# DIRECT REPLACEMENT GUIDE

## (including obsolete Mullard Valves)

*Types marked with asterisk (*) are replacements in AC receivers only. In AC/DC receivers it will be necessary to shunt the heater of the replacement valve, as the heater current of this valve differs from that of the original type.*

*The data provided on this chart assumes that the valve to be substituted was being operated under the manufacturer's recommended conditions.*

| Type Number | Replacement | Type Number | Replacement | Type Number | Replacement |
|---|---|---|---|---|---|
| AB1 | † | AZ3 | † | CB1 | † |
| AC/DD (Hivac) | **2D4A** | AZ32 | † | CB2 | † |
| AC/DD (Mazda) | † | AZ33 | † | CBC1 | † |
| AC/DDT | **TDD4** | A11B | **IW4/350** | CC2 | **HL13** |
| AC/HL | **354V** | A11C | **IW4/500** | CF1 | **SP13** |
| AC/HLDD | **TDD4** | A11D | **IW4/350** | CF2 | **VP13A** |
| AC/HP | **SP4** | A20B | **2D4A** | CF3 | † |
| AC/PEN | **PEN4VA** | A23A | **TDD4** | CF7 | **SP13** |
| AC/Q | † | A27D | **PEN4DD** | CK1 | **FC13** |
| AC/Qa | † | A30D | **354V** | CL6 | † |
| AC/SG | † | A36A | **TH4** | CY1C | **UR1C** |
| AC/SGVM | † | A36B | **TH4B** | CY2 | † |
| AC/SH | † | A36C | **TH4B** | CY32 | † |
| AC/SL | **SP4** | A40M | † | C10B | **UR1C** |
| AC/SIVM | **VP4** | A50A | **SP4** | C12FM | **MW31-16** |
| AC/S2 | **SP4** | A50B | **SP4B** | C20C | † |
| AC/S2PEN | † | A50M | **VP4 (7-pin)** | C23B | **TDD13C** |
| AC/TH1 | **TH4B** | A50N | **VP4A** (7-pin) | C27D | † |
| AC/VH | † | A50P | **VP4B** | C30B | **HL13C** |
| AC/VP (5-pin) | † | A70B | **PEN4VA** (7-pin) | C36A | **TH21C** |
| AC/VP (7-pin) | **VP4A** | A70C | **PENA4** | C36C | **TH30C** |
| AC/VPB | **VP4B** | A70D | **PENA4** | C50B | **SP13C** |
| AC/VP1 | † | A70E | **PENB4** | C50N | **VP13C** |
| AC/VP2 | **VP4B** | A80A | **FC4** | C70D | **PEN36C** |
| AC/Y | † | A430N | **354V** | C80B | **FC13C** |
| AC/Z | **PENA4** | BVA211 | **DW4/350 or IW4/350** | DA | † |
| AC/2DD | † | BVA214 | | DACI | † |
| AC2/PEN | **PENA4** | BVA215 | | DD4 | **2D4A** |
| AC2/PENDD | † | BVA216 | | DD4s | **AB2** |
| AC4/PEN | **PENB4** | BVA243 | | DD6 (Cossor / Ferranti) | **EB91** |
| AF2 | † | BVA246 | **EF39** | DD6 (Tungsram) | † |
| AL5 | † | BVA247 | | DD6ds | **EB4** |
| AL60 | † | BVA264 | | DD13 | † |
| APP4A | **PEN4VA** | BVA265 | **EL33** | DD13s | † |
| APP4As | † | BVA266 | | DD465 | † |
| APP4B | **PENA4** | BVA267 | | DD620 | † |
| APP4Bs | **AL4** | BVA274 | | DDA1 | **2D4A** |
| APP4E | **PENB4** | BVA275 | **ECH35** | DDL4 | **2D4A** |
| APV4 | **IW4/350** | BVA276 | | DDPP4B | † |
| AS4120 | **SP4** | B228 | **PM2HL** | DDPP4Bs | **ABL1** |
| AS4125 | † | | | | |
| AZ2 | † | | | | |

† *No direct replacement available. Please refer to Near Equivalent Guide.*

## DIRECT REPLACEMENT GUIDE

| Type Number | Replacement | Type Number | Replacement | Type Number | Replacement |
|---|---|---|---|---|---|
| DDPP4M | **PEN4DD** | ECH41 | † | HP210nc (4-pin) | † |
| DDPP6B | † | EF2 | † | HP211c | **VP2** |
| DDPP6Bs | **EBL1** | EF5 | **EF9** | HP215 (Hivac) | † |
| DDPP39 | † | EF6 | † | HP4101c | **SP4** |
| DDPP39M | † | EF8 | **EF9** | HP4105 | **VP4** |
| DDPP39s | **CBL1** | EF38 | **EF39** | HP4106c | **VP4** |
| DDT | † | EK3 | † | HP4115c (5-pin) | † |
| DDT2 | **TDD2A** | EL3N | **EL3** | HP4115c (7-pin) | **VP4A** |
| DDT4 | **TDD4** | EL5 | † | HR210 | **PM2HL** |
| DDT4s | **ABC1** | EL6 | † | H2 | **PM2HL** |
| DDT6s | **EBC3** | EL36 | † | H2D | **TDD2A** |
| DDT13 | **TDD13C** | EZ1 | † | H4D | † |
| DDT13s | † | E220B | **PM2B** | H210 | **PM2HL** |
| DDT215 | † | E235 | **PM202** | IW3 | **IW4/350** |
| DDT220 | **TDD2A** | FG17 | **MT17** | IW4 | **IW4/500** |
| DET22 | **ME1001** | FG57 | **MT57** | KT2 | **PM22A** |
| DF1 | † | FG105 | **MT105** | KT24 | **PM22A** |
| DH42 | **TDD4** | GN24 | **DW4/350** | KT41 | † |
| DH63 | † | G431 | **DW2** | KT42 | **PEN4VA** |
| DH63M | **EBC33*** | G470 | **DW2** | KT61 | † |
| DH142 | **UBC41** | G2080 (5-pin) | **URIC** | KT63 | † |
| DH147 | **EBC33** | G2080 (P base) | **CY1** | KT66 | **EL37** |
| DH150 | **EBC41** | G4120 | **DW4/500** | KTW61 | † |
| DK1 | † | G4120N | **IW4/500** | KTW61M | † |
| DL2 | † | HAD | † | KTW63 | † |
| DL63 | **EBC33*** | HD14 | **DAC32** | KTZ63 | † |
| DL91 | † | HD22 | **TDD2A** | K23B | **TDD2A** |
| DN41 | † | HD23 | **TDD2A** | K30A | **PM2HL** |
| DN143 | **EBL21** | HD24 | **TDD2A** | K30B | † |
| DO42 | **PEN4DD** | HL2 | **PM2HL** | K30C | **PM2HL** |
| DP61 | **EF95** | HL2K | **PM2HL** | K30D | **PM2HL** |
| DP495 | **PEN4DD** | HL4+ | **354V** | K30G | **PM2A** |
| DP4480 | † | HL4g | † | K30K | **PM2HL** |
| DT41 | **TDD4** | HL4gs | † | K40B | † |
| DT436 | **TDD4** | HL13 | **HL13C** | K40N | **PM12M** |
| DT1336 (7-pin) | **TDD13C** | (Tungsram) | | K50M | **VP2** |
| DTU1 | **TDD13C** | HL13 (Hivac) | † | K50N | **VP2B** |
| DW3 | **DW4/350** | HL13s | **HL13** | K70B | **PM22A** |
| DW4 | **DW4/500** | HL21DD | **TDD2A** | K70D | **PM22D** |
| D4 | **354V** | HL22 | † | K77B | **QP22B** |
| D41 | **2D4A** | HL23DD | † | K80A | **FC2** |
| D63 | **EB34*** | HL41 | † | K80B | **FC2A** |
| D77 | **EB91** | HL41DD | † | K435/10 | **ACO44** |
| D152 | **EB91** | HL133DD | † | LD210 | † |
| D400 | **2D4A** | HL210 | **PM2HL** | LL2 | **PM2HL** |
| D1300 | † | HLA2 | **354V** | LL2s | † |
| EAF41 | † | HLB1 | † | LN152 | **ECL80** |
| EC50 | † | HL/DD1320 | † | LP2 (Osram) | **PM2A** |
| EC55 | **ME1001** | HP13 | † | LP2 (Ferranti) | **PM202** |
| ECH2 | † | HP13s | **VP13A** | LP4 | **ACO44** |
| ECH4 | † | HP210nc (7-pin) | **SP2** | LP220 | **PM2A** |

** See note at beginning of section.* † *No direct replacement available. Please refer to Near Equivalent Guide.*

## DIRECT REPLACEMENT GUIDE

| Type Number | Replacement |
|---|---|
| L2 (Ferranti) | **PM2A** |
| L2 (Mazda) | **PM2ML** |
| L2/B | **PM2ML** |
| L2/DD | † |
| L21 | **PM2ML** |
| L21/DD | **TDD2A** |
| L210 | **PM2ML** |
| ME6s | **EM1** |
| MH4 | **354V** |
| MHD4 | † |
| MHL4 | † |
| MKT4 | **PEN4VA** |
| MM4V | † |
| MP4106c | **VP4** |
| MP/PEN | **PEN4VA** |
| MPT4 | **PEN4VA** |
| M54B | **SP4** |
| MS4C | **SP4** |
| MSG/HA | **SP4** |
| M5G/LA | **SP4** |
| M5P4 | **SP4** |
| MS/PEN | **SP4** |
| M5/PENA | **SP4** |
| MU12 | **IW4/350** |
| MU12/14 | **IW4/500** |
| MU14 | **IW4/500** |
| MV/SG | † |
| MVS/PEN (5-pin) | † |
| MV5/PEN (7-pin) | **VP4A** |
| MV5/PENB | † |
| N14 | **DL35** |
| N15 | † |
| N16 | **DL33** |
| N17 | **DL92** |
| N19 | **DL94** |
| N40 | † |
| N41 | **PENA4** |
| N63 | † |
| N66 | **EL37** |
| N77 | **EL91** |
| N142 | **UL41** |
| N144 | **EL91** |
| N147 | **EL33** |
| N150 | **EL41** |
| N151 | **EL42** |
| N152 | **PL81** |
| OM1 | **CY31** |
| OM3 | **EB34** |
| OM4 | **EBC33** |
| OM5 | **EF36** |
| OM5A | **EF37** |
| OM5B | **EF37A** |
| OM6 | **EF39** |
| OM7 | **EF39** |
| OM9 | **EL32** |
| OM10 | **ECM35*** |
| OP41 | **PENB4** |
| OP42 | **PENA4** |
| O202 | **FC2** |
| O406 | **FC4** |
| O1307 (P base) | **FC13** |
| O1307 (7-pin) | **FC13C** |
| PB1 | **PM2A** |
| PEN4V | † |
| PEN4VB | **PENA4** |
| PEN24 | † |
| PEN25 | † |
| PEN26 | † |
| PEN40DD | † |
| PEN220 | **PM22A** |
| PEN230 | † |
| PEN231 | **PM22D** |
| PEN3520 | **PEN36C** |
| PENA1 | **PM24M** |
| PENB1 | **PM22A** |
| PENDD4020 | † |
| PL17 | **MT17** |
| PL21 | **2D21** |
| PL57 | **MT57** |
| PL105 | **MT105** |
| PL1267 | **1267** |
| PM1A | **PM2ML** |
| PM1HF | **PM2ML** |
| PM1HL | **PM2ML** |
| PM1LF | † |
| PM2 | † |
| PM2DL | **PM2ML** |
| PM2DX | **PM2ML** |
| PM12 | † |
| PM12A | † |
| PM22 | † |
| PM24 | † |
| PM24B | † |
| PM24C | † |
| PM252 | † |
| PP2 | **PM22A** |
| PP2s | **KL4** |
| PP4 | **PM24M** |
| PP4s | † |
| PP6As | **EL2** |
| PP6BG | **EL33** |
| PP6Bs | **EL3** |
| PP34 | † |
| PP34s | **CL4** |
| PP35 | **PEN36C** |
| PP36 | † |
| PP220 | **PM202** |
| PP3/250 | **ACO44** |
| PT2 | **PM22A** |
| PT4 (Marconi / Osram) | **PM24M** |
| PT4 (Ferranti) | **PENA4** |
| PT4D | † |
| PT41 | **PM24M** |
| PTZ | † |
| PV4 | **DW4/350** |
| PV29s | † |
| PV30 | **UR3C** |
| PV30s | † |
| PV495 | **DW2** |
| PV4200 | **DW4/500** |
| PVB6s | † |
| PX4 | **ACO44** |
| PX230 | **PM202** |
| P2 | **PM202** |
| P12/250 | **ACO44** |
| P220 (Tungsram) | † |
| P220 (Mazda / Hivac) | **PM2A** |
| P220A | **PM202** |
| P225 (5-pin) | **PM22A** |
| P240 | **PM202** |
| P435 | **PM24M** |
| P440N | **PEN4VA** |
| P441N | **PEN4VA** |
| P495 | **PENA4** |
| QP230 | **QP22B** |
| QP240 (Mazda) | † |
| QP240 (Hivac) | † |
| QPT2 | † |
| Q583/3 | **85A2** |
| RV120/350 | **DW4/350** |
| RV120/350s | **AZ1** |
| RV120/500 | **DW4/500** |
| RV120/500s | † |
| RV200/600 | **FW4/800** |
| RZ | **UR1C** |
| R1 | **DW2** |
| R2 | **IW4/350** |
| R3 | **IW4/500** |

** See note at beginning of section.* † *No direct replacement available. Please refer to Near Equivalent Guide.*

# DIRECT REPLACEMENT GUIDE

| Type Number | Replacement | Type Number | Replacement | Type Number | Replacement |
|---|---|---|---|---|---|
| R4 | **DW4/350** | 51324 | † | U84 | † |
| R4A | **DW4/500** | 51328 | **SP13** | U101 | † |
| R12 | **EY51** | TDD2 | † | U142 | **UY41** |
| R14 | **PZ30** | TDD13 | † | U143 | **AZ31** |
| R41 | **DW4/500** | TH4 | † | U145 | **UY41** |
| R42 | **IW4/350** | TH4A | **TH4B** | U147 | **EZ35** |
| R52 | **GZ32** | TH22C | **TH30C** | U149 | † |
| SD2 | **PM2HL** | TH29 | **TH30C** | U150 | **EZ40** |
| SE211c | **PM12M** | TH30 | **TH30C** | U151 | **EY51** |
| SG215 | **PM12M** | TH41 | † | U152 | **PYB0** |
| SG215A | **PM12M** | TH62 | † | U201 | **CY31** |
| 5P4 (Tungsram) | † | TH233 | † | U403 | † |
| 5P4C | † | TH2321 | **TH30C** | U404 | **UY41** |
| 5P4s | **AF7** | TP2S | † | U4020 | † |
| 5P6 | **EF91** | TT4 | † | VHT2 | **FC2** |
| 5P6s | † | TV4 | † | VHT2A | **FC2A** |
| 5P13 (Tungsram) | † | TV6 | **EM1** | VHT4 | **FC4** |
| 5P13B | **SP13C** | TX4 | † | VHTA | † |
| 5P13s | **SP13** | TX21 | **TH21C** | VM4V | † |
| 5P22 | † | TX41 | **TH4B** | VMP4 | **VP4** |
| 5P210 | **SP2** | T41 (Ekco) | **354V** | VMP4G | † |
| 5P215 | † | UAF41 | † | VM54 | † |
| 5P220 | **PM202** | UCH4 | † | VMS4B | † |
| 5P1320 | **SP13C** | UCH41 | † | VO2 | **FC2A** |
| 5PT2 | **SP2** | UD2 | **PM202** | VO2s | **KK2** |
| 5PT4A | **SP4 (7-pin)** | UR1 | **CY1** | VO4 | **FC4** |
| SS210 | † | UR2 | † | VO4s | **AK2** |
| SU61 | **EY51** | UR3 | † | VO6s | **EK2** |
| S4V | **SP4** | UU3 | **IW4/350** | VO13 | **FC13C** |
| S4VA | **SP4** | UU4 | **IW4/350** | VO13s | **FC13** |
| S4VB | **SP4** | UU5 | **IW4/500** | VP4C | † |
| 511A | **DW2** | UU6 | † | VP6 | **EF92** |
| 511D | **DW4/350** | UU8 | † | VP13 | † |
| 521 | † | UU9 | **EZ40** | VP13B | **VP13C** |
| 522 | † | UU60/250 | **IW4/350** | VP22 | † |
| 523 | † | UU120/350 | **DW4/350** | VP41 (Mazda) | † |
| 524 | † | UU120/350A | **IW4/350** | VP41 (Ekco) | **VP4B** |
| 530C | **ACO44** | UU120/500 (Mazda) | **DW4/500** | VP133 | † |
| 530D | † | UU120/500 (Hivac) | **IW4/500** | VP210 | † |
| S213 | **PM12M** | UY31 | † | VP215 | † |
| S215 | † | U10 | **DW2** | VP1321 | † |
| 521SA | † | U12/13 | **DW4/350** | VP1322 | **VP13C** |
| 5215B | † | U14 | **DW4/500** | VPT2 | † |
| 5215VM | **PM12M** | U18/20 | **FW4/500** | VPT4 | **VP4 (5-pin)** |
| 5217 | **VP2** | | **FW4/800** | VPT4B | **VP4A** |
| 5218 | **SP2** | U31 | **PY31** | VPU1 | **VP13C** |
| 5420 | **VP4B** | U50 | † | V52 | **PM12M** |
| 5434N (5-pin) | † | U70 | **EZ35** | V524 | **PM12M** |
| 5434N (7-pin) | **VP4A** | U82 | † | VS24K | **PM12M** |
| S435N | **SP4** | | | V5210 | **PM12M** |
| | | | | VS215 | **PM12M** |

† *No direct replacement available. Please refer to Near Equivalent Guide.*

| Type Number | Replacement | Type Number | Replacement | Type Number | Replacement |
|---|---|---|---|---|---|
| VX2 | **VP2B** | IA7VG | **DK32** | 4D1 | † |
| VX2s | † | IAC6 | **DK92** | 4G/280K | **2D21** |
| VX32 | **ME1401** | IC1 (Mazda) | **DK91** | 4THA | † |
| V20 | **URIC** | IC5G | **DL35** | 4XP | **ACO44** |
| V20s | **CY1** | IC5GT/G | **DL35** | 4/100BU | **FW4/500** |
| V30 | † | IC6 | † | 5CP1–A | **DG13-2** |
| WD142 | **UAF42** | IC7G | † | 5CP7–A | **DP13-2** |
| WD150 | **EAF42** | ID5 | † | 5FP7–A | **MF13-1** |
| W17 | **DF91** | ID6 | † | 5V4G | **GZ32** |
| W21 | † | ID7G | † | 5Y3G | † |
| W42 | † | ID13 | **DA90** | 5Y4G | † |
| W63 | † | IE5G | † | 5Z4G | **GZ32** |
| W77 | **EF92** | IF2 | **DF92** | 6A6 | † |
| W142 | **UF41** | IF3 | **DF91** | 6A7 | † |
| W143 | **EF22** | IF4 | † | 6A7E | † |
| W147 | **EF39** | IF5G | **KL35** | 6A8G | † |
| W150 | **EF41** | IFD9 | **DAF91** | 6A8GT | † |
| X14 | **DK32** | IH5G | **DAC32** | 6AB8 | **ECL80** |
| X17 | **DK91** | IH5GT/G | **DAC32** | 6AG6G | **EL33** |
| X21 | **FC2** | IH6G | † | 6AK5 | **EF95** |
| X22 | **FC2** | IL4 | **DF92** | 6AK6 | † |
| X42 | † | ILA6 | † | 6AL5 | **EB91** |
| X61M | **ECH35** | ILC5 | † | 6AM5 | **EL91** |
| X65 | † | ILD5 | † | 6AM6 | **EF91** |
| X142 | **UCH42** | ILH4 | † | 6AT6 | † |
| X143 | **ECH21** | ILN5 | † | 6BD6 | † |
| X147 | **ECH35** | IN5G | † | 6BE7 | **EQ80** |
| X150 | **ECH42** | IN5GT/G | **DF33** | 6BT6 | † |
| YD2 | † | IN5VG | **DF33** | 6BX6 | **EF80** |
| Y61 | † | IP10 | **DL92** | 6C6 | † |
| Y62 | † | IP11 | **DL94** | 6C10 | **ECH42** |
| Y63 | † | IQ5GT | **DL36** | 6CJ6 | **EL81** |
| Y220 | † | IR5 | **DK91** | 6D1 (Mazda) | **EA50** |
| ZD17 | **DAF91** | IS4 | † | 6D2 | **EB91** |
| ZD152 | **EBF80** | IS5 | **DAF91** | 6D6 | † |
| Z14 | **DF33** | IT4 | **DF91** | 6E8G | **ECH35** |
| Z21 | † | IU5 | † | 6F12 | **EF91** |
| Z22 | **SP2** | 2D4 | † | 6F16 | **EF41** |
| Z77 | **EF91** | 2D13 | † | 6H6GT | **EB34*** |
| Z90 | **EF50** | 2D13A | † | 6J6 | **ECC91** |
| Z142 | **UF42** | 2D13C | † | 6J7G | † |
| Z150 | **EF42** | 2D21 | **2D21** | 6J7GT | **EF37A*** |
| Z152 | **EF80** | 2J42 | **ME1101** | 6J8G | † |
| 0A4G | **1267** | 3A4 | **DL93** | 6K7G | † |
| 0E3 | **85A1** | 3A5 | **DCC90** | 6K7GT | **EF39*** |
| 1A3 | **DA90** | 3NP4 | **MW6-2** | 6K8G | † |
| 1A4E | † | 3Q4 | † | 6K8GT | † |
| 1A4P | † | 3Q5GT/G | **DL33** | 6L6G | † |
| 1A7G | † | 3S4 | **DL92** | 6L34 | **EC91** |
| 1A7GT/G | **DK32** | 3V4 | **DL94** | 6M6G | **EL33** |

* *See note at beginning of section.* † *No direct replacement available. Please refer to Near Equivalent Guide.*

## DIRECT REPLACEMENT GUIDE

| Type Number | Replacement | Type Number | Replacement | Type Number | Replacement |
|---|---|---|---|---|---|
| 6N7GT/G | † | 16A5 | **PL82** | 2105PG | **FC2** |
| 6N8 | **EBF80** | 17Z3 | **PY81** | 2105PT | † |
| 6P8G | **ECH35*** | 19X3 | **PY80** | 210VPT (4-pin) | † |
| 6P28 | † | 19Y3 | **PY82** | 210VPT (7-pin) | † |
| 6Q7G | † | 20A1 | **TH4B** | 215P | † |
| 6Q7GT | † | 20A3 | **2D21** | 2155G | **PM12M** |
| 657 | **EF39*** | 21A6 | **PL81** | 220HPT | **PM22A** |
| 657G | † | 25RE | † | 220/OT | **PM22A** |
| 65C7 | † | 25Y5 | † | 220P | † |
| 65J7 | † | 25Z4G | † | 220PA | **PM2A** |
| 6SK7 | † | 25Z5 | † | 2205G | † |
| 6SL7GT | **ECC35*** | 25Z6G | † | 220VS | **PM12M** |
| 65N7GT | † | 35RE | † | 220VSG | **PM12M** |
| 6U5/6G5 | † | 36 | † | 230PT | † |
| 6U7G | † | 39/44 | † | 230XP | † |
| 6V6G | † | 40SUA | † | 240QP | **QP22B** |
| 6W7G | † | 41E | † | 244V | **354V** |
| 6X2 | **EY51** | 41/MHF | **354V** | 302THA | **TH30C** |
| 6X5G | **EZ35** | 41/MHL | **354V** | 332PEN | **CL33** |
| 6X5GT/G | **EZ35** | 41/MPG | **FC4** | 408BU | **DW2** |
| 6ZY5G | † | 41/MPL | **354V** | 442BU | **DW4/350** |
| 7A2 | **PEN4VA** | 41/M5G | **SP4** | 460BU | **DW4/500** |
| 7A3 | **PENA4** | 41/MTL | **354V** | 484V | † |
| 7A7 | † | 415TH | † | 506BU | **DW2** |
| 7B7 | † | 42/42E | † | 723A/B | **ME1100** |
| 7C5 | † | 42MP/PEN | **PENA4** | 927 | **55CG** |
| 7D6 | **PEN36C** | 42/OT | **PENA4** | 1267 | **1267** |
| 7D9 | **EL91** | 431U | **IW4/350** | 1561 | **DW4/500** |
| 7F7 | † | 441U | **IW4/500** | 1821 | **DW2** |
| 7K7 | † | 451U | † | 1861 | **IW4/500** |
| 757 | † | 54KU | **GZ32** | 1867 | **IW4/350** |
| 7Y4 | † | 62DDT | **EBC41** | 1877 | **HVR2** |
| 8A1 | **SP4** | 62TH | **ECH42** | 1881 | **IW4/350** |
| 8D2 | † | 62VP | **EF41** | 2101 | † |
| 8D3 | **EF91** | 635PT | **EF50** | 2102 | † |
| 9A1 | **VP4** | 64ME | **EM34** | 4065 | **ME1401** |
| 9D2 | † | 66KU | **EZ40** | 5544 | **MT5544** |
| 9D6 | **EF92** | 67PT | **EL41** | 5545 | **MT5545** |
| 10D1 | † | 77/77E | † | 5557 | **MT17** |
| 11A2 | † | 78/78E | † | 5559 | **MT57** |
| 12AT7 | **ECC81** | 80 | † | 5802 | **ME1401** |
| 12XP4 | **MW31-16** | 84/6Z4 | † | 5861 | **ME1001** |
| 12Z3 | † | 121K | **MW31-16** | 55035 | **ME1101** |
| 13PGA | † | 202DDT | **TDD13C** | | |
| 135PA | † | 2025TH | **TH21C** | | |
| 13VPA | † | 210DDT | **TDD2A** | | |
| 15 | † | 210DET | **PM2HL** | | |
| 15A2 | † | 210HF | **PM2HL** | | |
| 15A6 | **PL83** | 210LF | † | | |
| 15D1 | † | 210PG | **FC2** | | |

**See note at beginning of section.* † *No direct replacement available.* *Please refer to Near Equivalent Guide.*

# NEAR EQUIVALENT GUIDE

| Type Number | BASE | Mullard Replace-ment | BASE | CONVERSION |
|---|---|---|---|---|
| ABI | O | **2D4A** | O | No circuit change. 2D4A has no top cap. |
| AC/DD (Mazda) | O | **2D4A** | O | No circuit change. 2D4A has no top cap. |
| AC/Q | M | **PENB4** | M | Bias may require adjustment. |
| AC/Qa | K | **EL37** | K | Bias may require adjustment. |
| AC/SG | O/M | **SP4** | O/M | Raise Vg2 to 100V for R.F. amplifier. |
| AC/SGVM | O/M | **VP4** | O/M | Raise Vg2 to 100V for R.F. amplifier. |
| AC/SH | M | **SP4** | M | Bias may require adjustment. |
| AC/S2PEN | M | **SP4** | M | Bias may require adjustment. |
| AC/VH | O | **VP4** | O | Bias may require adjustment. |
| AC/VP (5-pin) | O | **VP4A** | M | Change base. |
| AC/VPI | M | **VP4B** | M | Rewire base. |
| AC/Y | O/M | **PEN4VA** | O/M | Bias may requlre adjustment. |
| AC/2DD | M | **PEN4DD** | M | Interchange connections to pins 2 and 6. |
| AC2/PENDD | M | **PEN4DD** | M | Rewire base. |
| AF2 | O | **VP4A** | M | Change base. |
| AL5 | P | **PENB4** | M | Change base. |
| AL60 | M | **PENB4** | M | Rewire base. Change Rk to 175Ω. |
| APP4As | P | **PEN4VA** | O/M | Change base. |
| AS4125 | O | **VP4** | O | Volume control will be less gradual in operation. |
| AZ2 | P | **FW4/500** | A | Change base. |
| AZ3 | P | **IW4/350** | A | Change base. |
| AZ32 | K | **FW4/500** | A | Change base. |
| AZ33 | K | **IW4/350** | A | Change base. |
| A40M | O | **VP4** | O | Volume control will be less gradual in operation. |
| CBI<br>CB2 | V<br>V | **EB34** | K | Change base. When rewiring connect separate cathodes of EB34 together. EB34 : Vh=6·3V. |
| CBCI | P | **TDDI3C** | M | Change base. |
| CF3 | P | **VPI3C** | M | Raise Vg2 to Va. |
| CL6 | P | **CL4** | P | Change Rk to 170Ω. Raise Vg2 to 200V. |
| CY2 | P | **UR3C** | M | Change base. |
| CY32 | K | **UR3C** | M | Change base. |
| C20C | O | **EB34** | K | Change base. When rewiring connect separate cathodes of EB34 together. EB34 : Vh=6·3V. |
| C27D | M | **CBL31** | K | Change base. |
| DA | M | **HLI3C** | M | Bias may require adjustment. |
| DACI | P | **DAC32** | K | Change base. |

## NEAR EQUIVALENT GUIDE

| Type Number | BASE | Mullard Replace-ment | BASE | CONVERSION |
|---|---|---|---|---|
| DD6 (Tungsram) | O | **EB34** | K | Change base. |
| DD13<br>DD13s | O<br>V | **EB34** | K | Change base. When rewiring connect separate cathodes of EB34 together. EB34 : Vh=6·3V. |
| DD465 | O | **2D4A** | O | Rewire base. |
| DD620 | O | **EB34** | K | Change base. |
| DDPP4B | M | **PEN4DD** | M | Rewire base. |
| DDPP6B | M | **EBL31** | K | Change base. |
| DDPP39 | M | **CBL31** | K | Change base. |
| DDPP39M | M | **CBL31** | K | Change base. |
| DDT | M | **TDD4** | M | Bias may require adjustment. |
| DDT13s | P | **TDD13C** | M | Change base. |
| DDT215 | O | **TDD2A** | O | Bias may require adjustment. |
| DF1 | P | **DF33** | K | Change base. |
| DH63 | K | **EBC33*** | K | Earth pin 1. |
| DK1 | P | **DK32** | K | Change base. |
| DL2 | P | **DL35** | K | Change base. |
| DL91 | B7G | **DL92** | B7G | Rewire base so that Vf is between pin 5 and pins 1 and 7 connected together. |
| DN41 | M | **PEN4DD** | M | Rewire base. Raise Vg2 to Va. Increase Rk to 140Ω. |
| DP44B0 | M | **CBL31** | K | Change base. |
| D1300 | P | **EB34** | K | Change base. When rewiring connect separate cathodes of EB34 together. EB34 : Vh=6·3V. |
| EAF41 | BBA | **EAF42** | BBA | Connect pins 4 and 7 together. |
| EC50 | P | **EN31** | K | Change base. |
| ECH2 | P | **ECH3** | P | ECH3 : Ih=0·3A. |
| ECH4 | P | **ECH21** | BBG | Change base. |
| ECH41 | BBA | **ECH42** | BBA | Screen grid resistors may need alteration. |
| EF2 | P | **EF9** | P | Bias may require adjustment. |
| EF6 | P | **EF36** | K | Change base. |
| EK3 | P | **EK2** | P | Raise Vg2 to 200V. EK2 : Ih=0·2A. |
| EL5 | P | **EL35** | K | EL35 : Vg2=250V max. Change Rk to 180Ω. Change base. |
| EL6 | P | **EL35** | K | EL35 : Vg2=250V max. Change Rk to 180Ω. Change base. |
| EL36 | K | **EL35** | K | EL35 : Vg2=250V max. Change Rk to 180Ω. |
| EZ1 | P | **EZ35** | K | Change base. EZ35 : Ih=0·6A. |
| HAD | M | **TDD13C** | M | Bias may require adjustment. |
| HL4g | M | **354V** | O | Change base. |
| HL4gs | P | **354V** | O | Change base. |
| HL13 (Hivac) | M | **HL13C** | M | Shunt heater with 130Ω, 2W resistor. |
| HL22 | MO | **PM2HL** | A | Change base. |
| HL23DD | MO | **KBC32** | K | Change base. |

## NEAR EQUIVALENT GUIDE

| Type Number | BASE | Mullard Replace-ment | BASE | CONVERSION |
|---|---|---|---|---|
| HL41 | MO | **354V** | O | Change base. |
| HL41DD | MO | **TDD4** | M | Change base. |
| HL133DD | MO | **TDDI3C** | M | Change base. |
| HLBI | A | **PM2HL** | A | Bias may require adjustment. |
| HL/DD1320 | M | **TDDI3C** | M | Bias may require adjustment. |
| HPI3 | M | **VPI3A** | P | Change base. |
| HP210nc (4-pin) | A | **SP2** | M | Change base. |
| HP215 (Hivac) | M | **SP2** | M | Raise Vg2 to Va. |
| HP4115c (5-pin) | O | **VP4A** | M | Change base. |
| H4D | M | **TDD4** | M | Bias may require adjustment. |
| KT41 | M | **PENA4** | M | Bias may require adjustment. |
| KT61 | K | **EL33** | K | Bias may require adjustment. |
| KT63 | K | **EL32** | K | Rewire base. |
| KTW61 | K | **EF39*** | K | Earth pin 1. Bias may require adjustment. |
| KTW61M | K | **EF39*** | K | Bias may require adjustment. |
| KTW63 | K | **EF39*** | K | Earth pin 1. |
| KTZ63 | K | **EF37A*** | K | Connect pin 5 to pin 8. |
| K30B | A | **PM2HL** | A | Change Vg1 to —1·5V. |
| K40B | A | **PMI2M** | A | Raise Vg2 to 90V. |
| LD210 | A | **PM2HL** | A | Bias may require adjustment. |
| LL2s | P | **PM2HL** | A | Change base. |
| L2/DD | O | **TDD2A** | O | Change Vg1 to —1·5V. Not suitable as Class B driver. |
| MHD4 | M | **TDD4** | M | Bias may require adjustment. |
| MHL4 | O | **354V** | O | Bias may require adjustment. |
| MM4V | O | **VP4** | O | Volume control less gradual in operation. |
| MV/SG | O | **VP4** | O/M | Bias may require adjustment. |
| MVS/PEN (5-pin) | O | **VP4A** | M | Change base. |
| MVS/PENB | M | **VP4B** | M | Raise Vg2 to Va. |
| N15 | K | **DL33** | K | Increase bias. |
| N40 | O | **PEN4VA** | O/M | Bias may require adjustment. |
| N63 | K | **EL32** | K | Rewire base. |
| PEN4V | O | **PEN4VA** | O | Change Vg1 to —22V. No change with automatic bias. |
| PEN24 | MO | **KL35** | K | Change base. Change Vg1 to —4·5V. |
| PEN25 | MO | **KL35** | K | Change base. |
| PEN26 | P | **CL4** | P | Change Rk to 170Ω. CL4 : Vg2=200V. |
| PEN40DD | M | **CBL31** | K | Change base. |
| PEN230 | A/O | **PM22A** | A/O | Change Vg1 to —4·5V at Va=Vg2=135V and Ra to approximately 19KΩ. |
| PENDD4020 | M | **CBL31** | K | Change base. |
| PM1LF | A | **PM2HL** | A | Change Vg1 to —1·5V. |
| PM2 | A | **PM2A** | A | Change Vg1 to —6V. |
| PM12 | A | **PM12M** | A | Raise Vg2 to 90V. |

*See note at beginning of Direct Replacement Guide.

## NEAR EQUIVALENT GUIDE

| Type Number | BASE | Mullard Replacement | BASE | CONVERSION |
|---|---|---|---|---|
| PM12A | A | **PM12M** | A | Raise Vg2 to 90V. |
| PM22 | A/O | **PM22A** | A/O | Change Vg1 to −4·5V at Va=Vg2=135V and Ra to approximately 19KΩ. |
| PM24 | A/O | **PM24A** | O | Change base, if necessary. |
| PM24B | O | **PM24M** | O | Redesign circuit. PM24M : Va=Vg2=250V max. |
| PM24C | O | **PM24M** | O | Redesign circuit. PM24M : Va=Vg2=250V max. |
| PM252 | A | **PM2A** | A | Change Vg1 to −6V. Ra=7KΩ. |
| PP4s | P | **PM24M** | O | Change base. |
| PP34 | M | **PEN36C** | M | Connect g1 to T.C. |
| PP36 | M | **PEN36C** | M | Rewire base. |
| PT4D | M | **PEN4DD** | M | Rewire base. |
| PTZ | M | **PEN36C** | M | Rewire base. |
| PV29s | P | **UR3C** | M | Change base. |
| PV30s | P | **UR3C** | M | Change base. |
| PVB6s | P | **EZ35** | K | Change base. Check Ih when series heated. |
| P220 (Tungsram) | A | **PM202** | A | Bias may require adjustment. |
| QP240 (Mazda) | 9-pin | **QP22B** | M | Change base. |
| QP240 (Hivac) | M | **QP22B** | M | Bias may require adjustment. |
| QPT2 | M | **QP22B** | M | Bias may require adjustment. |
| RV120/500s | P | **DW4/500** | A | Change base. |
| SP4 (Tungsram) | M | **SP4** | M | Rewire base. |
| SP4C | P | **SP4B** | M | Change base. |
| SP6s | P | **EF37A** | K | Change base. |
| SP13 (Tungsram) | M | **SP13** | P | Change base. |
| SP22 | MO | **SP2** | M | Change base. |
| SP215 | M | **SP2** | M | Bias may require adjustment. |
| SS210 | A | **PM12M** | A | Raise Vg2 to 90V. |
| S21 | A | **PM12M** | A | Raise Vg2 to 90V. |
| S22 | A | **PM12M** | A | Raise Vg2 to 90V. |
| S23 | A | **PM12M** | A | Raise Vg2 to 90V. |
| S24 | A | **PM12M** | A | Raise Vg2 to 90V. |
| S30D | A | **ACO44** | A | Change Vf to 4V. |
| S215 | A | **PM12M** | A | Raise Vg2 to 90V. |
| S215A | A | **PM12M** | A | Raise Vg2 to 90V. |
| S215B | A | **PM12M** | A | Raise Vg2 to 90V. |
| S434N (5-pin) | O | **VP4A** | M | Change base. |
| S1324 | M | **SP13C** | M | Raise Vg2 to Va. |
| TDD2 | O | **TDD2A** | O | Change Vg1 to −1·5V. Not suitable as Class B driver. |
| TDD13 | P | **TDD13C** | M | Change base. |
| TH4 | M | **TH4B** | M | Change Rk to 140Ω. Grid leak to be increased to 50KΩ between grid and cathode. |

## NEAR EQUIVALENT GUIDE

| Type Number | BASE | Mullard Replacement | BASE | CONVERSION |
|---|---|---|---|---|
| TH41 | MO | **TH4B** | M | Change base. Receiver may require re-aligning. |
| TH62 | K | **CCH35** / **ECH35** | K | For AC/DC receivers—CCH35. For AC receivers—ECH35. |
| TH233 | MO | **TH30C** | M | Change base. Receiver may require re-aligning. |
| TP25 | MO | **KCF30** | K | Change base. |
| TT4 | O | **EC31** | K | Change base. Raise Vh to 6·3V. |
| TV4 | P | **EM1** | P | Raise Vh to 6·3V. |
| TX4 | M | **TH4B** | M | Change Rk to 140Ω. Grid leak to be increased to 50KΩ between grid and cathode. |
| UAF41 | 88A | **UAF42** | 88A | Connect pins 4 and 7 together. |
| UCH4 | K | **UCH21** | 88G | Change base. |
| UCH41 | 88A | **UCH42** | 88A | Screen grid resistor may need alteration. |
| UR2 | P | **UR3C** | M | Change base. |
| UR3 | P | **UR3C** | M | Change base. |
| UU6 | MO | **IW4/350** | A | Change base. |
| UU8 | MO | **GZ32** | K | Change base. GZ32, Vh=5V. |
| UY31 | K | **UY21** | 88G | Change base. |
| U50 | K | **GZ32** | K | GZ32 has indirectly heated cathode. |
| U82 | 88G | **EZ35** | K | Change base. |
| U84 | 88G | **AZ31** | K | Change base. |
| U101 | 88G | **UY21** | 88G | Join pins 2, 4 and 6 together. |
| U149 | 88G | **EZ35** | K | Change base. |
| U403 | MO | **CY31** | K | Change base. Check Ih=0·2A. |
| U4020 | O | **UR1C** | O | Check Ih=0·2A. |
| VHTA | M | **FC13C** | M | Vg2 max.=90V. Receiver may require realigning. |
| VM4V | O | **VP4** | O | Volume control less gradual in operation. |
| VMP4G | M | **VP4A** | M | Bias may require adjustment. |
| VMS4 | O | **VP4** | O | Volume control will be less gradual in operation. |
| VMS4B | O | **VP4** | O | Volume control will be less gradual in operation. |
| VP4C | M | **VP4B** | M | Rewire base. |
| VP13 | M | **VP13A** | P | Change base. |
| VP22 | MO | **KF35** | K | Change base. |
| VP41 (Mazda) | MO | **VP4B** | M | Change base. |
| VP133 | MO | **VP13C** | M | Change base. Bias may require adjustment. |
| VP210 | M | **KF35** | K | Change base. |
| VP215 | M | **VP2** | M | Increase Vg2 to Va. |
| VP1321 | M | **VP13C** | M | Change base connections. |
| VPT2 | M | **VP2** | M | Increase Vg2 to Va. |
| VX2s | P | **VP2B** | M | Change base. |
| V30 | O | **UR1C** | O | Check Ih=0·2A. |

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| Type Number | BASE | Mullard Replacement | BASE | CONVERSION |
|---|---|---|---|---|
| W21 | M | **VP2** | M | Join pins 3 and 4 together. |
| W42 | M | **VP4A** | M | Rewire base. |
| W63 | K | **EF39*** | K | Bias may require adjustment. |
| X42 | M | **FC4** | M | Bias may require adjustment. |
| X65 | K | **ECH35** | K | Earth pin 1. Receiver may require realigning. |
| YD2 | A | **PM2A** | A | Bias may require adjustment. |
| Y61 | K | **EM34** | K | Supply a2 (pin 6) from H.T., through 1MΩ resistor. |
| Y62 | K | **EM34** | K | |
| Y63 | K | **EM34** | K | Interchange connections, to pins 4 and 5. |
| Y220 | O | **PM22A** | O | Bias may require adjustment. |
| Z21 | M | **SP2** | M | Earth pin 3. |
| 1A4E | UX | **KF35** | K | Change base. |
| 1A4P | UX | **KF35** | K | Change base. |
| 1A7G | K | **DK32** | K | Earth pin 1. |
| 1C6 | UX | **KK32** | K | Change base. |
| 1C7G | K | **KK32** | K | Earth pin 1. |
| 1D5 | O | **URIC** | O | Check Ih=0·2A. |
| 1D6 | UX | **PY31** | K | Change base. Check Ih=0·3A. |
| 1D7G | K | **KK32** | K | Earth pin 1. |
| 1E5G | K | **KF35** | K | Earth pins 1 and 5. |
| 1F4 | UX | **KL35** | K | Change base. |
| 1H6G | K | **KBC32** | K | Rewire base. |
| 1LA6 | B8G | **DK32** | K | Change base. |
| 1LC5 | B8G | **DF33** | K | Change base. |
| 1LD5 | B8G | **DAF91** | B7G | Change base. |
| 1LH4 | B8G | **DAC32** | K | Change base. |
| 1LN5 | B8G | **DF33** | K | Change base. |
| 1N5G | K | **DF33** | K | Change base. |
| 1S4 | B7G | **DL92** | B7G | Rewire base so that Vf is between pin 5 and pins 1 and 7 connected together. |
| 1U5 | B7G | **DAF91** | B7G | Rewire base. |
| 2D4 | O | **2D4A** | O | Rewire base. 2D4A has no top-cap. |
| 2D13 | V | **EB34** | K | Change base, when rewiring connect cathodes of EB34 together. EB34 : Vh =6·3V. |
| 2D13A | V | **EB34** | K | |
| 2D13C | O | **EB34** | K | |
| 3Q4 | B7G | **DL94** | B7G | Rewire base. |
| 4D1 | M | **HL13C** | M | Earth pin 1. |
| 4THA | M | **TH4B** | M | Receiver may require realigning. |
| 5Y3G | K | **GZ32** | K | GZ32 is indirectly heated. |
| 5Y4G | K | **GZ32** | K | Rewire base. GZ32 is indirectly heated. |
| 6A6 | UX | **ECC33** | K | Change base. ECC33 unsuitable for use as Class B output valve. |
| 6A7 | UX | **EK32*** | K | Change base. Earth pin 1. Receiver may require realigning. |
| 6A7E | UX | **EK32*** | K | |

** See note at the beginning of Direct Equivalent Guide.*

## NEAR EQUIVALENT GUIDE

| Type Number | BASE | Mullard Replacement | BASE | CONVERSION |
|---|---|---|---|---|
| 6A8G | K | **EK32*** | K | Earth pin 1. Receiver may require realigning. |
| 6A8GT | K | **EK32*** | K | Receiver may require realigning. |
| 6AK6 | B7G | **EL91** | B7G | Rewire base. |
| 6AT6 | B7G | **EBC41** | B8A | Change base. |
| 6BD6 | B7G | **EF41*** | B8A | Change base. |
| 6BT6 | B7G | **EBC41*** | B8A | Change base. |
| 6C6 | UX | **EF37A*** | K | Change base. |
| 6D6 | UX | **EF39*** | K | Change base. |
| 6J7G | K | **EF37A*** | K | Earth pin 1. |
| 6J8G | K | **ECH35** | K | Earth pin 1. Bias may require adjustment. |
| 6K7G | K | **EF39*** | K | Earth pin 1. |
| 6K8G | K | **ECH35** | K | Earth pin 1. Receiver may require realigning. |
| 6K8GT | K | **ECH35** | K | Receiver may require realigning. |
| 6L6G | K | **EL37** | K | Bias may require adjustment. |
| 6N7GT/G | K | **ECC33** | K | Rewire base. ECC33 unsuitable as Class B output valve. |
| 6P28 | K | **EL38** | K | Rewire base. |
| 6Q7G | K | **EBC33*** | K | Earth pin 1. Bias may require adjustment. |
| 6Q7GT | K | **EBC33*** | K | Bias may require adjustment. |
| 6S7G | K | **EF39*** | K | Earth pin 1. |
| 6SC7 | K | **ECC35*** | K | Rewire base. |
| 6SJ7 | K | **EF36*** | K | Rewire base. |
| 6SK7 | K | **EF41*** | B8A | Change base. |
| 6SN7GT | K | **ECC33** | K | Bias may require adjustment. |
| 6U5/6G5 | UX | **EM34*** | K | Change base. Supply a2 from H.T. through 1MΩ resistor. |
| 6U7G | K | **EF39*** | K | Earth pin 1. |
| 6V6G | K | **EL33** | K | Bias may require adjustment. |
| 6W7G | K | **EF37A*** | K | Earth pin 1. |
| 6ZY5G | K | **EZ35** | K | EZ35 Ih=0·6A, 6ZY5G Ih=0·3A. |
| 7A7 | B8G | **EF22*** | B8G | Bias may require adjustment. |
| 7B7 | B8G | **EF22*** | B8G | Bias may require adjustment. |
| 7C5 | B8G | **EL41** | B8A | Change base. Bias may require adjustment. |
| 7F7 | B8G | **ECC35*** | K | Change base. |
| 7K7 | B8G | **EBC41** | B8A | Change base. |
| 7S7 | B8G | **ECH21*** | B8G | Rewire base. Receiver may require realigning. |
| 7Y4 | B8G | **EZ35** | K | Change base. |
| 8D2 | M | **SP13C** | M | Increase Vg2 to Va. |
| 9D2 | M | **VP13C** | M | Earth pin 1. Raise Vg2 to 200V. |
| 10D1 | O | **EB34** | K | Change base. When rewiring connect cathodes of EB34 together. EB34 : Vh =6·3V. |

*See note at the beginning of Direct Equivalent Guide.*

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| Type Number | BASE | Mullard Replace-ment | BASE | CONVERSION |
|---|---|---|---|---|
| 11A2 | M | **TDD4** | M | Earth pin 2. Bias may require adjustment. |
| 12Z3 | UX | **PY31** | K | Change base. Check Ih=0·3A. |
| 13PGA | M | **FC13C** | M | Vg2 max.=90V. |
| 13SPA | M | **SP13C** | M | Increase Vg2 to Va. |
| 13VPA | M | **VP13C** | M | Increase Vg2 to Va. |
| 15 | UX | **KF35** | K | Change base. |
| 15A2 | M | **FC4** | M | Vg2 max.=90V. |
| 15D1 | M | **FC13C** | M | Vg2 max.=90V. |
| 25RE | UX | **PY31** | K | Change base. Check Ih=0·3A. Only suitable as half-wave rectifier. |
| 25Y5 | UX | **PY31** | K | Change base. Check Ih=0·3A. Only suitable as half-wave rectifier. |
| 25Z4G | K | **PY31** | K | Check Ih=0·3A. |
| 25Z5 | UX | **PY31** | K | Change base. Check Ih=0·3A. Only suitable as half-wave rectifier. |
| 25Z6G | K | **PY31** | K | Rewire base. Check Ih=0·3A. Only suitable as half-wave rectifier. |
| 35RE | UX | **PZ30** | K | Change base. Check Ih=0·3A. |
| 36 | UX | **EF36*** | K | Change base. |
| 39/44 | UX | **EF39*** | K | Change base. |
| 40SUA | O | **UR1C** | O | Check Ih=0·2A. |
| 41E | UX | **EL32** | K | Change base. |
| 41STH | M | **TH4B** | M | Bias may require adjustment. |
| 42/42E | UX | **EL32** | K | Change base. |
| 45IU | A | **FW4/500** | A | FW4/500 is directly heated. |
| 77/77E | UX | **EF37*** | K | Change base. |
| 7B/7BE | UX | **EF39*** | K | Change base. |
| 80 | UX | **GZ32** | K | Change base. |
| 84/6Z4 | UX | **EZ35** | K | Change base. |
| 210LF | A | **PM2HL** | A | Bias may require adjustment. |
| 210SPT | M | **SP2** | M | Increase Vg2 to Va. |
| 210VPT (4-pin) | O | **VP2** | M | Change base. Increase Vg2 to Va. |
| 210VPT (7-pin) | M | **VP2** | M | Increase Vg2 to Va. |
| 215P | A | **PM2A** | A | Increase Vg1 to −6V. |
| 220P | A | **PM2A** | A | Bias will require adjustment. |
| 220SG | A | **PM12M** | A | Increase Vg2 to 90V. |
| 230PT | A/O | **PM22A** | A/O | Change Vg1 to −4·5V at Va=Vg2=135V and Ra to approximately 19KΩ. |
| 230XP | A | **PM202** | A | Bias may require adjustment. |
| 484V | O | **354V** | O | Change Vg1 to −4·5V or Rk to 700Ω. |
| 2101 | UX | **KL35** | K | Change base. |
| 2102 | UX | **KBC32** | K | Change base. |

** See note at the beginning of Direct Equivnlent Guide.*

# TECHNICAL DATA

Mullard